TAYLOR'S

PRINCIPLES AND PRACTICE
OF
MEDICAL JURISPRUDENCE

Volume I

ALFRED SWAINE TAYLOR, M.D., F.R.S.
1806—1880

For forty-six years Lecturer in Medical Jurisprudence at Guy's
Hospital Medical School, London.

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ELEVENTH EDITION

Edited by

SIR SYDNEY SMITH

C.B.E., LL.D., M.D. (Edin.), F.R.C.P. (Edin.), Hon. M.D. (Louvain)
D.P.H., F.R.S. (Edin.)

EMERITUS PROFESSOR OF FORENSIC MEDICINE, UNIVERSITY OF
EDINBURGH, CONSULTANT IN FORENSIC MEDICINE TO WORLD HEALTH
ORGANIZATION; FORMERLY PRINCIPAL MEDICO-LEGAL EXPERT,
EGYPTIAN GOVERNMENT SERVICE; PROFESSOR OF FORENSIC MEDICINE,
UNIVERSITY OF EGYPT

Assisted by

KEITH SIMPSON

M.D., Lond. (Path.).

READER IN FORENSIC MEDICINE, UNIVERSITY OF LONDON; HEAD OF
DEPARTMENT OF FORENSIC MEDICINE, GUY'S HOSPITAL, LONDON;
ASSOCIATE IN POLICE SCIENCE, HARVARD UNIVERSITY

THE LEGAL ASPECT *revised by*

Gerald Howard, Q.C., M.P.

BARRISTER-AT-LAW, RECORDER OF IPSWICH
FORMERLY SENIOR TREASURY COUNSEL

PSYCHIATRY AND THE LAW *contributed by*

David Stafford-Clark

M.D., M.R.C.P., D.P.M.

PHYSICIAN IN CHARGE, DEPT. OF PSYCHOLOGICAL MEDICINE, GUY'S
HOSPITAL; DIRECTOR, THE YORK CLINIC

THE CHEMICAL ASPECT *revised by*

L. C. Nickolls, M.Sc., A.R.C.S., F.R.I.C.

DIRECTOR, METROPOLITAN POLICE LABORATORY, NEW SCOTLAND YARD

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PREFACE TO THE ELEVENTH EDITION

SINCE Taylor brought out the first edition of this work just 90 years ago, the world has witnessed startling advances in all the physical sciences and a great, though not so spectacular, advance in the biological sciences. It would be true to say, I think, that in the past half century progress in science has been greater than in the whole previous history of mankind. The development of new instruments and new techniques has given the chemist, the physicist and the biologist new means of acquiring knowledge of the intimate structure and reactions of matter, of the manner in which so-called poisonous substances interfere with the functions of cells or the enzymes which are essential to their use. The serologist has pursued his researches into the elements of blood and tissues and has obtained greatly increased knowledge of identification and inheritance.

Our knowledge of the human mind and human behaviour has been extended and enlarged and we have witnessed a regular advance in our concepts of the place of punishment and reform in connection therewith. It would be wrong, however, to think that the enormous advances in medical and social science have been accompanied by a commensurate improvement in the human mind.

Successive editors of "Taylor" have endeavoured to keep the book abreast of these advances but the field has widened to such an extent that it has gradually become too vast to be covered by any one man. In this edition I have been fortunate in obtaining the assistance of Dr. Keith Simpson in the general editorship, and I have no doubt that his influence will be observed in most sections of the work. I have also had the privilege of enlisting the collaboration of Mr. Gerald Howard Q.C. in the revision of the legal aspects. His long experience of medical affairs as seen in the Courts of Justice and in the General Medical Council should be of unique value to our readers. The section on Psychiatry and the Law has been largely rewritten by Dr. David Stafford-Clark whose advanced and balanced views on mental disease and behaviour are well-known. Mr. Nickolls, Director of the Metropolitan Police Laboratory at New Scotland Yard, has undertaken the revision of the toxicological section from the laboratory side. He has had an experience of toxicological procedures which is denied to most people in this country.

In this new edition a somewhat more radical revision has been attempted in order to keep "Taylor" abreast of the times. Several sections notably those on Post-mortem changes; on Intersexuality as an identity problem; on the general procedure of Criminal Investigation; on Regional Wounds; Blood in Identity, Trauma and Disease and the sections on Asphyxia and on Life Assurance have been very largely rewritten.

In Volume II Abortion and Infanticide and the greater part of the section on Toxicology have been similarly revised. Times change, and both modern views and current practice demanded major change in the text. No less than 292 new cases have been introduced into the first volume, together with some 40 new illustrations.

In the section on post-mortem change Dr. Keith Mant gave considerable assistance and for his help we thank him. We desire also to record apprecia-

tion of the general help in proof reading given by Mr. R. Furbank, and in checking the bibliography by Mr. W. Hill, Librarian at Guy's Hospital Medical School. Dr. Keith Simpson's secretary, Miss J. Scott Dunn, undertook the major task of providing typescript from both editors' manuscript, and her great care and patience contributed much to the smooth collaboration achieved with the publishers in this new edition.

Apart from certain individual acknowledgements for illustrations there remains a record of thanks to be made to both the Commissioner of Police of the Metropolis and to the Assistant Commissioner (Crime) Mr. R. L. Jackson for permission to use other unspecified photographs which appear for the first time in this edition.

The assistance of the chemist, the physicist, the biologist and of experts in other branches of science has given greater precision in our work with a corresponding increase in the value of evidence. Over all, however, there must be someone who is able to advise on the procedure to be adopted, the particular scientist whose help should be sought, and who takes a final responsibility of advising the Crown. Thus there would appear to be no lessening in the need for a general work such as this on forensic medicine, nor in the need for instructing medical practitioners on accurate observation. In that respect it is of interest to note how accurate Taylor was in his general observations and how little his forthright advice has been changed by time.

Edinburgh 1955.   SYDNEY SMITH.

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CHAPTER I

INTRODUCTION

Definition. The time has long since passed when it could be expected of a medical witness that he should possess an intimate knowledge of all branches of medicine. The scope of application of the basic sciences and of the many sections of medicine which may lend their aid to the needs of the law—from anatomy or biochemistry to therapeutics or pathology—has so increased that it becomes important to define a general medical practitioner's duties at law in entirely different terms from those of a specialist with particular claims in this field: the latter may profess a knowledge of forensic pathology, toxicology, serology or psychiatry which is quite outside the scope of the ordinary medical man's training in legal medicine.

Medical Jurisprudence, an older term for legal or forensic medicine, is a subject which should equip both the general practitioner and the specialist for their particular services to the law, and the purpose of this work is, to bring within the reach of both medicine and the law some knowledge of those problems which confront both professions when on common ground.

Scope. Medico-legal knowledge consists not so much in the acquisition of facts, as in the power of arranging them in an orderly way, in drawing sound conclusions from them and in applying these to the needs of the law. A man may show skill and competence in the handling of professional matters and an erudition in his subject, yet lack the ability to express his views to others—least of all, perhaps, to those without knowledge of medical matters. A master in his art may be incompetent as a witness, surpassed perhaps in the giving of evidence by one who is much inferior in professional standing.

Palmer, in his Life of Hunter, wrote:

John Hunter stood at the head of his profession: and if sound professional knowledge could have qualified any man to act as a medical witness, Hunter was fully qualified. Yet this great man, when giving evidence in 1781 on a memorable trial for poisoning, was obliged to confess that he was unable to give a definite answer to the important question put to him. Hunter was the only professional witness called on the part of the prisoner to rebut the charge of poisoning the deceased by Laurel-water. His cross-examination, however, rather strengthened the case for the prosecution; and the final question put by the court was: "Give your opinion, in the best manner you can, one way or the other, whether, upon the whole of the symptoms described, the death proceeded from the medicine (laurel-water), or any other cause?" His answer was: "I do not mean to equivocate; but when I tell the sentiments of my own mind, what I feel at the time, I can give nothing decisive."

The facts of the case were that a young man, previously in good health, expired in convulsions about half an hour after taking a draught of rhubarb and jalap sent by his medical man with which it was alleged the accused had mixed laurel-water.

The victim's mother observed that the draught smelt of bitter almonds when administered. Ten days after death the body was exhumed and examined by several medical men. The examiners did not open the brain and they did not investigate the condition of the intestines. No analysis either of the contents of the stomach or of the remainder—if any—of the draught was made. Hunter deposed that the appearances found in the stomach were ordinary *post-mortem* changes with which he was quite familiar, and that the symptoms with which the victim died were quite compatible with apoplexy or epilepsy. He admitted in cross-examination that the occurrence of the symptoms immediately after taking the draught was a circumstance in favour of its having caused them, and "if", said he, "I *knew* that the draught had contained poison, I should say that most probably the symptoms arose from that." He was, however, directed by the judge to separate the *medical facts* which he had observed from the suggestion that poison had been administered: and, on this direction, he declared that there was no direct medical evidence to show how death had been caused. The accused was convicted and hanged. .

Analysing this case in the light of our present-day knowledge, so far at least as the medical evidence is concerned, the conviction seems to have rested almost entirely on circumstantial evidence. There can be no doubt that if death was due to poisoning at all it was due to poisoning by a dilute solution of hydrocyanic acid, but the *post-mortem* evidence, apart from the smell, was indecisive. Hunter's evidence was as straightforward as his knowledge would permit, for the smell would probably have passed off in ten days, and there were then no means available for exact analysis of the contents of the stomach, but he might reasonably have been expected to have given a more definite answer on the balance of probabilities.

The law asks that a medical practitioner should exhibit a degree of knowledge commensurate with his station and a care in its application to practice which could be regarded as reasonable in the circumstances. This principle applies to practice in all branches of medicine, to surgery, obstetrics, public health, etc., and, of course, to forensic medicine. It must not be forgotten that it applies equally to the discharge of routine legal duties by the ordinary practitioner in his examination and treatment of patients, in certification and in his relation to civil or criminal procedure in which his help is sought. He should be an impartial observer, intent only on seeking the truth of a case in relation to its circumstances; the conscience with which he discharges his duties is but a corollary to his putting into practice the medico-legal knowledge he has acquired.

blood stains, and the forensic pathologist may equally excuse himself from comment on criminal psychiatry or the EEG, but a great many of the questions on which he is asked to give an opinion might well be considered within the competence of a well educated practitioner.

A knowledge of the principles on which forensic medicine is based must, therefore, be within the grasp of all practitioners not only in the matter of aid to those concerned in the administration of justice but also to preserve their own reputation and the good name of the medical profession. A doctor cannot afford to be ignorant of everyday problems in legal medicine.

MAKING MEDICO-LEGAL OBSERVATIONS

SOME medical men who have treated forensic medicine with indifference have occasionally ventured to appear as witnesses, and have believed that the subjects on which they were likely to be examined were so much beyond the knowledge of the judge and of the lawyers engaged in the case that even hazardous or rash statements would escape observation. Nothing could be further from the truth, many lawyers possess a good deal of medico-legal knowledge; and are quite able to detect when a witness is attempting to avoid giving a proper answer by vague or evasive statements or by the use of technical language. Counsel engaged in any civil or criminal case of importance take care to inform themselves of the views of standard medical writers; and they are not likely to be put off by an erroneous or evasive answer to a medico-legal question.

It is certainly a common fault of medical men that they are often not prepared for the complex and difficult questions which are likely to arise in a case upon which they know they will be required to give evidence. This lack of preparation applies to facts as well as to opinions. For instance, in a case of death which may result in a charge of murder or manslaughter, a medical man who attended the deceased may often omit to observe many circumstances connected with the case because they appeared at the time to be irrelevant or of little importance, although at the subsequent trial he may find that upon them depends the final issue. As a result of professional habit medical observation is, on these occasions, confined as a rule to only one set of circumstances, *i.e.*, the diagnosis and treatment of disease or personal injury; but medico-legal observation should take a much wider range, and should be directed to all the surrounding facts and incidents of the case. Circumstances which are of no interest from a medical or surgical point of view are often of the greatest value and importance in legal medicine. If all these facts are not observed by a medical witness upon his first dealing with the case, it may be beyond his power to answer many questions which must arise during the trial. The lack of careful observation is a serious matter, and may result in an imputation of professional ignorance.

The first duty, therefore, of a medical practitioner is to cultivate a habit of accurate observation, the exercise of which is by no means inconsistent with the performance of the duties of a physician or surgeon. Medical men possess this power to a variable degree, as the following incidents show:

premises at the time was an intimate friend of the deceased, against whom there was no suspicion; but this acute observation led to the arrest and trial of the friend, and to his subsequent conviction for murder.

A doctor was called to a Leyton house to see a man who had been found dead on the return of his wife from a two-hour shopping trip. She had, just before leaving, admitted a stranger who had an appointment to see her husband. There was no disturbance in the room and without moving the body or closely examining it the doctor reported the death as "a sudden death from causes unknown". A later examination showed a bullet hole in the shirt and a pool of blood between the shoulder blades and the floor. There was no weapon there and the case was plainly one of murder. As a result of the improper medical opinion an armed suspect remained at large for over a day.

The circumstances, the locality, position of the body of a person who has been found dead, the position of any weapon found on the scene, and the condition of the clothing, as well as the form and direction of any wound, are not always noticed with sufficient accuracy. They may instantly disclose the nature of a case.

One of the authors was called to a house at Watford where a woman and child lay dead on the floor of the kitchen, vomit soiling the face of each. Suspicion of poisoning had arisen and the husband was suspected.

A police officer left to guard the scene was found after two hours to be complaining of headache, dizziness and nausea. It was noticed that both bodies bore very pink livid stains and search revealed two wool sanitary packs obstructing the flue of the kitchen stove, causing CO fumes to accumulate: both deaths were accidental.

Reasonable care in making observation may dispel suspicion and avert criminal enquiry.

On the other hand, lack of observation may lead to the acquittal of guilty persons.

A woman was found dead in her bed. The scalp was lacerated and there were grounds for believing that the wounds had been produced by criminal violence. For the defence it was suggested that, as there were projecting nails at the head of the bed, these lacerations might have arisen from accident—a suggestion which was supported to some extent by the medical evidence. An experienced witness, however, stated that from his examination he did not believe that the nails, even if they were in the bedstead at the time of the occurrence, could have produced the wounds. He said also that as blood had issued from the wounds, and as there was no blood upon the nails or upon the part of the bed around them, he did not believe that the head had at any time come into contact with the nails. Those who were first called to the dead body had omitted to notice whether there was anything on or near the bed to account for the wounds on the scalp, *and they were quite unable to say whether there were or were not any projecting nails at the head of the bed when they first examined the body.* The accused was discharged on the Scottish verdict of "Not proven"; and there was some reason to believe that he escaped through manufactured evidence, in that the nails had been driven into the head of the bed subsequent to the death of the woman. It seems perfectly clear, however, from a general view of the medical evidence, that the wounds could not have been produced by nails in the manner suggested. The accused was given the benefit of the doubt which had been raised in the minds of the jury.

The judge who tried this case remarked that *"a medical man, when he sees a dead body, should notice everything."* A medical man should make it a rule to observe everything which could throw a light upon the production of wounds or of other injuries found upon the dead body. It should not be only for the police to say whether there were any marks of blood on the clothing, or on the hands of the deceased, or on the furniture in the room. The clothing of the deceased, as well as the body, should always be closely examined by a medical man at once, on the spot.

Another matter of great importance which is frequently omitted when examining a dead body is the duty to observe whether, at the time of examination, the body or any part of it was still warm[1], whether the limbs were cold and rigid, or cold and pliant. From a medical or surgical point of view, these conditions of the body are of little importance; but, if these facts be observed, they may enable a witness to speak with greater probability as to the time of death; this may make all the difference between the acquittal and conviction of a person charged with murder.

A girl's body was found fully dressed (at 8.30 a.m.) lying on the low tide and bank of the Thames under a parapet of Waterloo Bridge during its reconstruction. A police surgeon was called to certify the fact of death and was asked (a) about when she had died, and (b) if there was cause for suspicion. He put a hand on the body and pronounced it "dead four to seven days". He appreciated that there was a broken leg "probably from a jump off the bridge".

On arrival at the public mortuary, the body was found to have (a) an internal (rectal) temperature of 47°F. (air temp. 38°F., Thames river 31°F.), (b) marks of strangling on the neck. These observations indicated that death was due to violence and that the death had occurred within hours rather than days as suggested by the police surgeon. It transpired that the girl had been murdered by a soldier on the partly constructed bridge "soon after closing time" (11 p.m.) the previous evening and pushed over into the river. A conviction for murder followed, substantiated partly by closer timing of death (11–12 p.m.) very shortly after accused had left a local public house in the girl's company.

The circumstances which chiefly require notice on these occasions have been fully described in the chapter on Wounds. In cases of supposed death from poison, other matters also will require immediate attention; these will be found in detail in the chapters on Poisoning.

One of the chief purposes of counsel when defending persons charged with murder or manslaughter is to endeavour to discover what the medical man engaged in the case omitted to do. Although sometimes the omission may be of no medical importance whatever, yet it may be placed before the jury in such a strong light that the accused may obtain the benefit of a doubt and secure acquittal. The omission may be attributed to professional ignorance, or (what is worse) to professional bias—a determination to find proofs of guilt against the "unhappy prisoner at the bar"—when the facts might easily be explained by the witness's lack of experience in dealing with cases of this nature.

In *R. v. Smith*[2] (the "Brides in the Bath" case) it was held that medical evidence in the form of opinions by medical witnesses is admissible as evidence if such opinions are given in the exercise of professional skill and knowledge with regard to assumed facts.

NOTES AND REPORTS ON CASES

Notes. In the ordinary course of practice there can be no doubt that the more complete are the notes which are kept of every case of sickness or injury the better it is for the patient and for the medical man in the event of any question which might necessitate the production of records, whether they be kept in a day-book or not. Such notes may be of great service in refreshing the mind of a medical man when he is called upon to provide reports or give evidence. Whereas to a very busy practitioner such a course may be impracticable, it is of the utmost importance that all medical men should make as

[1] For details of a method of estimating the lapse of time since death by heat loss and other data see p. 167, *et seq.*

[2] (1915) 23 Cox, 271.

copious notes as possible immediately there is the slightest degree of suspicion that any case may ultimately become the subject of a medico-legal inquiry; this is especially to be emphasised in the case of an accident, however trivial, inasmuch as legal redress is frequently sought by those injured through accident or by their dependant relatives.

When it becomes certain that a case will eventually be the subject of legal inquiry it is the duty of the medical man to commit to writing at the earliest possible moment everything which he has observed of the case hitherto, everything which he is then able to observe, and, if the case does not terminate at once, the details of its further course. In various parts of this work (*e.g.*, in the chapters on "Rape," "Wounds," etc.) special reference will be made to the notes which ought to be taken. The medical man's own observations must be kept distinct from information given to him by others; he may draw conclusions of value from the former, but the latter must be proved before any conclusions can be drawn therefrom. They may be false.

Many weeks may elapse before a person charged with a crime, or defending some claim, is brought before the judge and jury. However clear the circumstances may appear to a medical practitioner at the date of his examination of the body, it will require more than ordinary powers of memory to retain for so long a period a distinct recollection of all the facts of a case. If no notes have been made, and the memory be defective, the case may result in favour of the accused, and the administration of justice suffer through the neglect of the medical witness.

At the trial of Harold Greenwood in 1920 on a charge of murder by arsenic, the general practitioner attending was questioned closely by Marshall Hall, counsel for the defence, as follows:

M. Hall. "What tonic did you give Mrs. Greenwood?" (The witness produced a paper containing a copy of the prescription and handed it to counsel. It had been "copied from the prescription book").

Counsel. "When did you copy this?" "Last night." "Who did you get it from?" "Out of my book." "Where is the book?" "At home." "Why did you not bring the book? *Just be careful, doctor. Is there a book?*" "It is at home."

The judge ordered Dr. G. to "bring here any book or papers you have containing entries relating to prescriptions made out for Mrs. G." The court adjourned, and on re-opening Sir Edward Marshall Hall again pressed the doctor.

Counsel. "Will you point out the entry in the book which you referred to in the morning." "The entry is not in it. I kept it in an old prescription book and the old book has been destroyed. I thought I had copied it into this book."

The law relative to the admissiblity of notes or memoranda in evidence is very strict, and, in trials for murder, is rigorously enforced by the judges. In order to render such notes or memoranda admissible, it is essential that they should have been made by the witness at the time when the observations were made, or as soon afterwards as practicable; further, a witness is allowed to refer to such notes only for the purpose of refreshing his memory. Though he cannot read them audibly in the witness-box, giving them as his evidence, he may, and usually does, refer to them freely. If he is known to have such notes, he may be required to produce them. He need neither be afraid nor ashamed to produce soiled or bloodstained notes of an autopsy. Dirt does not destroy their value, and may be evidence of *bona fides*—by the inference that they were in fact made at the earliest moment[1].

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[1] Notes dictated by a pathologist to a secretary during autopsy are acceptable if read over immediately upon completion of the *post mortem* and signed. The same principle applies to a clinical examination.

At a trial for murder some years ago the judge commented: He (his lordship) had always found that when a witness said he had such a good memory that he took no notes, that witness was either very vain or very inaccurate. Dr. B. said that he found two pieces of lead behind the tongue, whereas, in fact, he did not find them at all. His partner found the pieces. These points were not vital to the case, but they were, at any rate, important points.

At the *R. v. Haigh* trial at Lewes Assizes in 1949, the Attorney General commenced his cross-examination of the psychiatrist called by the defence as follows[1]:

Cross-examined by the Attorney-General: "You said when you gave your evidence that you had seen the prisoner five times, you had examined him five times. This is not accurate, is it?" "I believe it to be accurate or I should not have said so."

"Look at your notes. When did you see him first?" "I really do not know the dates—between the first and sixth July."

"Would you accept it from me that the first time you saw the prisoner was on the first July?" "Yes."

"For twenty-five minutes?" "Yes, I dare say."

"The second time, on the second July, for one hour?" "Yes."

"And the third time on the fifth July for forty-five minutes?" "Yes."

"You visited Brixton Prison on two other occasions and discussed the case with Dr. Matheson?" "Yes."

"You never saw the prisoner, did you?" "I do not think that is quite right." "I am quite prepared to accept it, and I am sorry if I have made a mistake."

"I do not want you to accept anything which is not right. I want you merely to be accurate. Have you not any notes of your interviews?" "I have got large notes of the interviews with the prisoner, but I have not got notes of the days on which I actually visited him."

"I must put it to you that you saw him in all for two hours and ten minutes, forty minutes longer than your evidence has so far taken. Is that right?" "I do not know."

"Is it about right?" "I have got no idea."

This could not be described as a favourable start to a cross-examination in which the accuracy of the medical witness' notes was to be closely examined. The jury are bound to be affected by such questions and the doctor, quite needlessly, has his reliability badly shaken.

It is not in criminal cases only that notes ought to be made and preserved, for in civil cases it happens frequently that there is a very long interval between the occurrence of an accident or an illness and the trial of the case. Accurate records then prove invaluable.

Reports of a medico-legal nature are very frequently demanded from doctors, and these will necessarily be based upon the notes referred to. All such reports should consist of a summary of the relevant medical facts, and of the conclusions based upon them, expressed as far as possible in non-technical language.

Reports necessarily vary in their contents according to the nature of the case. The substance of a poisoning case will differ materially from that of a street accident, for instance; but there are a few rules which are applicable to all such reports, and they merit careful consideration.

Dates. These must in all cases be stated very carefully, and in such a manner as to leave no room for doubt, and to make it unnecessary to refer to calendars; *e.g.*, a phrase such as "Last Saturday I saw Mr. Jones" must never occur; it must run : "At 11 a.m. on Saturday, 26th January, 1950, I examined Mr. John Jones, at No. 5 Prospect Place, Kensington." Careful

distinction must be made between the date upon which the events took place and the date when the report was made.

Identity. The sex, age, and occupation of the person reported upon should be noted accurately. Formal identification is sometimes desirable.[1] The facts should in the first instance be stated *seriatim*, plainly and concisely, in language easily intelligible to non-professional persons. A report should be made not to display erudition, but to be understood. If technical terms are employed, their meaning should be stated in parentheses.

Opinions, inferences, or comments. The facts should be stated first, and the conclusions should be stated later in the report. The language in which the conclusions are expressed should be precise and clear. It must be remembered that these are intended to be a concise summary of the whole report, upon which the decision of a magistrate, or the verdict of a jury, may ultimately be based. Such conclusions should be confined strictly to the matters which are the subject of inquiry and have actually come under the observation of the witness.

Relation to circumstances. Deductions from the facts described should be based upon *medical* data only, not upon circumstances, unless the reporter is specially required to express his opinion in regard to them in cases where they are said to be related. Further, they must be founded only upon *what the writer has himself seen or observed.* Any information derived from other persons should be made the basis of an opinion in a medico-legal report only where it is proven, or at least open to examination. A conclusion based upon mere possibilities is of no value as evidence.

Notwithstanding the plainness, simplicity, and obvious nature of these rules, they are broken far too frequently, and it is desirable to call attention to the more common lapses. Statements are often set out in verbose or exaggerated language, overloaded with technical and unintelligible terms; the writer is often not sufficiently careful to keep the facts distinct from his comments, or his deductions from the facts. Whereas facts are vital as evidence, the comments and deductions of a witness are admissible only in evidence at court.

In regard to the first of these defects, too often it is the practice of medical men to use exaggerated language when writing reports of medical cases for professional purposes. Thus, in the writing of a report on an ordinary *post-mortem* examination, the lining-membrane of the stomach may be described as being "intensely" inflamed, or a cavity as "enormously" distended. Expressions employed in this loose manner may convey to the legal mind a meaning widely different from that intended by the reporter. They create great difficulty in evidence if withdrawn or modified, a change which, though necessary, may at the same time place the witness in an undesirable position before the court. If such descriptions involve a comparison, the question at once arises as to the standard by which they are measured, and as to the opportunity which the witness had of creating such a standard. As a rule it will be found that these terms have been used without careful consideration, or from a habit acquired from reporting cases for the information of medical men only. Lawyers look much more closely to the strict signification of words than do most medical men, and they are disposed always to mistrust the judgment of a person who cannot speak or write without employing the superlative degree.

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[1] *Vide Forbes* G. 1951. *Brit. med. J.*, 2, 227.

Medical men who freely employ technical terms when writing reports must bear in mind that they are reporting not to a medical society, but for the information and assistance of people who may never have heard of the terms used. In a report on the appearances in the body of a man who had suffered from chronic insanity, the following passage occurred: "The only morbid appearance in the brain was an atheromatous deposit in the Pons Varolii, near the situation of the locus niger." In another document the medical report stated, for the information of a coroner's jury, that the "integuments of the cranium were reflected, and the calvarium was exposed." Even educated persons, such as judges and stipendiary magistrates, do not as a rule include the meaning of technical medical terms within the range of their knowledge. Only a few of them understand the difference between perineum and peritoneum, or the meaning of the words hemispheres of the brain, or pia mater. They are not likely to know the difference between the cardia and pylorus, or the situation of the duodenum, jejunum, ileum, or cœcum, and may be as ready to consider them to be parts of the liver or urinary bladder as the intestines: on one occasion a learned judge asked for an explanation of the meaning of the term "alimentary canal." Use of everyday words like gullet, voice box or windpipe avoids misunderstanding and adds greatly to the ease with which a jury can follow the evidence. Technical medical language is quite out of place in a report which is intended to inform ordinary persons upon plain matters of fact, but in certain instances it may be a wise precaution to use the strict technical term as well as the more colloquial one to avoid misunderstanding.

Facts and comments upon facts, as well as hearsay statements and arguments, are sometimes found in combination. The facts alone are for the jury; the reporter's comments upon the facts may or may not be accurate or relevant, and unless relevant cannot be accepted as evidence. As a rule, nothing should be entered in a report which is not connected with the subject of inquiry, and which has not fallen directly under the observation of the reporter. The introduction of hearsay statements—*i.e.*, statements made by persons not called as witnesses—or circumstances which have come to his knowledge through rumour, should be avoided.

At the trial of M'Lachlan for murder, discussion arose upon what should and what should not find a place in a medical report. A report was put in which the police surgeon, who had been authorized to make a *post-mortem* examination of the body of the deceased, stated, at the beginning of his report, that the body had been found, "*under circumstances of great suspicion*", in a front room, etc. The judge remarked that this was matter which was not suitable for inclusion in a medical report. Moreover, with reference to the conclusions drawn, the first and third were as follows:

1. "That this woman" (the deceased) "was *murdered*, and that with extreme ferocity."

3. "*That a severe struggle had taken place before death.*"

The suggestion of murder was an anticipation of the verdict of the jury. The conclusion should have been merely that death had been caused by certain specified injuries. There was no proof of any struggle so far as the *post-mortem* examination went. The facts upon which the witness relied as evidence of a struggle were consistent equally with the dragging of the body after death. Such matters are best brought out in the form of question and answer in court.

In a report of an analysis in a case of poisoning, it is not necessary that all the details of the technique should be given. A general statement of the

results, indicated by certain tests and processes will be sufficient, provided, of course, that the witness keeps a written record of every part of the examination for production if required.

In the case of Cook and Ann Palmer[1] an application was made to Dr. Rees and Dr. Taylor to give to the prisoner's attorney, before the trial, a statement of the whole of the details of their analysis of antimony and of strychnine. They declined to do this without authority. The Court of Queen's Bench was appealed to, and Lord Campbell decided that there was no legal ground on which such a demand could be enforced. Inasmuch as the medical evidence against the prisoner was clear and conclusive, the counsel for the Crown advised that they should concede the point, although it was admitted to be in accordance with neither law nor custom. Upon this advice they acted, but it is not recommended that any scientific witness should follow such a course in future. The result was that, before the trial, these memoranda were placed in the hands of some chemists retained for the defence, with a view to hostile criticism.

In regard to the method of search for poisons, chemists may differ as to the process which it may be desirable to pursue in a given case; and although the same result may be reached by various methods, it is by no means difficult to find one who will assert that the only correct technique is his own, and that all others are fallacious, or to raise that element of doubt in the minds of a jury which may lead to the discrediting of sound evidence. An analyst must, however, be prepared for questions on the steps taken to eliminate contamination and minimise error.

DEPOSITIONS OF EVIDENCE

It is important that a medical witness should remember that copies of his report and depositions, either before a coroner or a magistrate, are placed as a rule in the hands of counsel as well as of the judge, and that his evidence, as it is given at the trial, is compared word for word with that which has been already put on record. The written depositions may be read out in court, when discrepancies between the depositions and the present evidence may provide material for cross-examination. There is reason to believe that this is not generally known to members of the medical profession, and thus it happens that either from failure of memory, want of accurate notes, or carelessness in giving evidence at coroners' inquests, medical witnesses may lay themselves open to criticism at the eventual trial.

Depositions, are always read over to the witness before he signs them. It is easy to correct any error which may have crept into the document during this stage. The doctor should see that it represents exactly what he did say, and permits of no ambiguity. Considerable latitude is allowed to witnesses and counsel to ensure their satisfaction over evidence that is to be used at trial, and the deposition should not be signed until the details are acceptable.

medical man who is giving evidence before a coroner (sometimes in the room of a small inn) is virtually delivering it before a judge of assize; and this fact alone should induce him to give the evidence guardedly, and with a due regard to the serious results to which exaggerations or misstatements may ultimately lead.

Reporting Deaths to the Coroner. Medical practitioners are often in doubt about their exact position in connection with the reporting of deaths to coroners, and it is as well that they should know exactly what their legal position is:—

1. There is no legally enforceable duty resting on a practitioner, acting as such, to report any death to a coroner.

2. The coroner has no power to require a practitioner to report any death to him.

3. It is the duty of the registrar of deaths to report deaths in certain circumstances to the coroner.

4. A practitioner must not do anything to obstruct the coroner in the discharge of his office.

5. A practitioner may make a post-mortem examination with the consent of the deceased's relatives, whether or not he knows the cause of death, unless by so doing he knowingly hinders the coroner in carrying out his duties; but, as soon as it comes to the knowledge of a practitioner that the coroner has been informed from any source touching the death, on no account should any examination of the body be made without instruction from the coroner[1].

It must not be assumed, however, that a doctor may leave the reporting of some death that he knows, or suspects, will have to be investigated by the coroner to take its strictly legal course of passage through the registrar's office. This consumes time which may be vital to satisfactory autopsy conditions, may seriously delay police enquiries, and must inevitably hamper the smooth efficiency of the coroner's procedure.

In *R. v. Shaughnessy* at the Hampshire Assizes in 1951 it transpired that a Portsmouth practitioner was summoned to a house one morning to see a young woman he had not attended previously. She was dead. He left the house, returning to his rounds, having lunch as usual. It was not until mid-afternoon that he informed the coroner's officer of a death, the cause of which he was "unable to certify". The coroner's officer found, on a routine visit for particulars, that the girl was lying in bed strangled by a loop of thick string which lay by her head, loosened: the police found her mother in a cupboard under the stairs, strangled by two nylon stockings.

During this long delay, easily avoidable if the doctor (whether or not he had noticed the plain marks of strangling) had not procrastinated in reporting the case, the strangler had left the town and made his way to Birmingham. He was a dangerous man and delay in reporting the death had resulted in his escaping "at large"—a situation which caused public alarm and considerable police expenditure before he was traced and arrested.

What is strictly law is not always good common sense. When a doctor is faced with an obscure or suspicious death it is his duty as a citizen, if not a doctor, to facilitate enquiry without delay: he would be wiser to telephone the coroner's officer or the police without wasting time or thought on the exact legal position.

Procedure. Cases which are reported to the coroner fall into two main categories:—

1. *Deaths reported by statutory obligation:*

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[1] Sir Roland Burrows, K.C., *Lancet*, 1943, **2**, 684

(a) by the Governor of a Prison, when the death of a prisoner or Borstal inmate takes place;

(b) by the Superintendent of a mental hospital of any mental patient whether certified or not (Mental Treatment Rules, 1948, S. I. No.1075), and S.1.1950 No.1223)

(c) by the licensee of a home or retreat for habitual drunkards (Habitual Drunkards Act, 1879, S.27);

(d) by persons in charge of registered foster children (Public Health Act, 1936, S.2, 13);

(e) by any person intending to remove a body out of England (Removal of Bodies from England Regulations, 1927, S. R. & O. No. 557);

(f) by the registrar in the event of unsatisfactory certification, where the doctor had not been in professional attendance during the 14 days prior to death or where he has reason to believe death is due to unnatural causes, is attended by suspicious circumstances, or is from unknown cause.

"Death from unnatural causes" includes any sort of accident (at any time prior to death), violence, neglect, poisoning (including therapeutic forms), scheduled industrial disease, drugs of addiction, blood and food poisoning—together with deaths before full recovery from anæsthesia.

2. *Deaths reported for investigation by a medical practitioner:*

(a) all deaths in class 1 (f) which would have to be reported by the registrar if the doctor (adhering strictly to his legal obligations) informed the registrar instead of the coroner direct. This class of death is one in which the coroner usually orders an autopsy to elucidate the circumstances of death;

(b) cases in which the cause of death is known to be natural but where *medical attention was not recent enough to satisfy the 14-day rule,* or where the doctor wishes to inform the coroner of some matter not falling into class 1 (f). These are cases where the coroner may, after enquiry, permit the doctor to issue a death certificate.

The coroner *may* hold an inquest in any case that is reported to him. He *must* do so if he is informed that there is lying within his jurisdiction the body of a person and there is reasonable cause to suspect that such person has died a violent, or an unnatural death, or has died in prison, or in such place or *in such circumstances as to require an inquest in pursuance of any* Statute.[1]

Originally all inquests were held by a coroner and a jury: the coroner is now given power to dispense with a jury, if he thinks fit, in certain cases, but a jury must be summoned where it appears to the coroner either before he proceeds to hold an inquest or in the course of an inquest begun without a jury, that there is reason to suspect

(a) That the deceased came by his death by murder, manslaughter or infanticide; or

(b) That the death occurred in prison or in such place or in such circumstances as to require an inquest under any Act other than the Coroners Act, 1887; or

(c) That the death was caused by an accident, poisoning or disease, notice of which is required to be given to a Government department, or to any inspector or other officer of a Government department, under or in pursuance of any Act; or

[1] Coroners Act, 1887, sec. 3

(d) That the death was caused by an accident arising out of the use of a vehicle in a street or public highway; or

(e) That the death occurred in circumstances the continuance or possible recurrence of which is prejudicial to the health or safety of the public or any section of the public.

In addition, the coroner has power to summon a jury in any other case if it appears to him, either before he proceeds to hold an inquest or in the course of an inquest begun without a jury, that there is any reason for summoning a jury.

The Coroners Rules, 1953 resulted in a timely restriction of enquiry in court to "how, where and by what means" the person concerned "came to his death". Questions of civil liability are specifically excluded from the jury's responsibilities.[1]

Viewing the Body. At or before the first sitting of an inquest on a body, the coroner must view the body, and if, before the body has been buried, the coroner so directs, or a majority of the jury so desires, the body must be viewed by the jury also[2].

Absence of Body. The normal jurisdiction of a coroner depends upon the existence and view of a dead body within the area for which he is coroner, but there are exceptions to this. Where a coroner has reason to believe that a death has occurred in or near the area within which he has jurisdiction, and that owing to the destruction of the body by fire, or otherwise, or to the fact that it is lying in a place from which it cannot be recovered, an inquest could not be held but for the provisions of the Coroners (Amendment) Act, 1926, s. 18, whereby he may report the facts to the Home Office, and that Department may order the coroner to hold an inquest, subject to the absence of the body and the consequent lack of "view" which is normally fundamental to the holding of an inquest.

In a similar manner, by a special war-time regulation[3] the coroner was given an entirely new jurisdiction to inquire into certain deaths that were alleged to have taken place owing to war operations.

Autopsy. Under the provisions of the Coroners' Rules, 1953, a coroner who requires an autopsy must have it made "as soon after the death... as reasonably practicable". He is advised to use the services of "a pathologist with suitable qualifications and experience and having access to laboratory facilities", and in the event of crime "should consult with the chief officer of police" regarding the choice of pathologist.

The "desire" of the pathologist to avoid making certain classes of autopsy — in particular those of his colleagues' operative/anaesthetic deaths or where the conduct of a member of his own staff is likely to be called into question —must now have due regard by the coroner.

Insistence on reasonable facilities, long overdue, received special emphasis. Where expensive litigation, insurance problems or criminal prosecution depend, as they may, on good conditions for sound autopsy work, then provision of every facility becomes of paramount importance. Many would consider it of equal importance that the doctor, surgeon or anaesthetist under criticism from relatives should not receive less careful attention than those

whose liberty is at stake. Speaking generally, the care and skill devoted to autopsy work has, in consequence of the practice of these rules, achieved a high standard. The coroner has wide discretionary powers to issue certificates of death after autopsy has shown that an inquest is unnecessary. Most cases falling into this category consist of deaths shown by autopsy to be due to natural causes, or to unavoidable surgical/anæsthetic risks.

Persons at a Medico-legal Autopsy. It should be made a rule that no unauthorised person should be present at the autopsy. Whereas this practice may lead to some injustice, or may wound the vanity of police or a practitioner, at all events it ensures the absence of any undesirable publicity or any attempt to obstruct the course of justice.

When (Dr.) Palmer, the prisoner charged with the murder by poison of Cook, was allowed to be present at the autopsy of his victim he deliberately attempted to destroy evidence of his crime, and had to be ejected[1].

The Coroners (Amendment) Act, 1926, s. 22 (4), provides that where a person states upon oath before the coroner that in his belief the death of the deceased was caused partly or entirely by the improper or negligent treatment of a medical practitioner or other person, that medical practitioner or other person shall not be allowed to perform or assist at any *post-mortem* or special examination made for the purposes of the inquest, but he shall have the right to be represented at such examination.

Sometimes a charge of malpraxis is raised against a medical man in consequence of the death of a patient. The examination of the body may, by order of a coroner, be placed unwittingly in the hands of a friend of the person concerned. This is not just either to the practitioner or to the public and in such cases an independent and experienced pathologist should always be entrusted with the *post-mortem* examination. Coroners have power to request specially qualified persons to make *post-mortem* examinations, analyses, etc., under the Coroners (Amendment) Act, 1926, and are specifically directed to do so by the Coroners Rules, 1953.

Documentary Evidence. These Coroners' Rules also directed that documentary evidence as to how death occurred should not be admissible, except where there was some special reason. This insistence on the doctor, pathologist—and more specifically, the laboratory expert—coming personally to give evidence on the cause of death avoids the possible misunderstanding of the report and gives the parties concerned an opportunity of asking questions upon it, thus leading to a fuller understanding of the matters at issue.

SUBPŒNA

Witnesses, medical and other, are summoned to give evidence, and to produce documents, before all courts, by writs of *"subpœna ad testificandum"* and *"subpœna duces tecum,"* which are familiarly known as *"subpœnas."*

Acceptance of Subpœna. Medical men occasionally attend a court, especially that of a coroner, without a *subpœna*; but such action is inadvisable, since a medical man's claim to his fee depends upon his attending an inquest in obedience to a summons[2]. If a medical man attends a civil court without a *subpœna,* he should take care to obtain in *writing* from the person who requests his attendance a satisfactory assurance in regard to his fees. If

[1] Trial of Wm. Palmer. Notable British Trials. Hodge.
[2] Coroners (Amendment) Act, 1926, s. 23.

possible, arrangements should be made for fees to be paid in advance in civil litigation.

Without a *subpœna*, or some written assurance as suggested above, a medical witness is not bound to appear, unless he makes a promise to attend for good consideration; if he fails to appear under such a promise, he may find himself in a similar position to that of the defendant in *Yeatman v. Dempsey*,[1]

> This was an action brought by a husband who alleged that his wife was insane at the date of the marriage, and where it was held that an action could be maintained against a medical man for failing to fulfil his promise to appear and to give evidence. The plaintiff was awarded £50 damages; and on appeal it was held that it was not necessary for the plaintiff to show that he would have succeeded in the Divorce Court with the aid of the evidence of the medical man.

If conduct money has been paid to a witness, but his attendance becomes unnecessary and he has incurred no expense, the conduct money is recoverable by the person who paid it. A medical witness, served with a *subpœna* for the purpose of giving expert evidence and not merely evidence as to the facts of the case, is entitled to claim compensation for loss of time as well as travelling expenses before giving evidence.[2]

A *subpœna* may be served upon a medical (or other) witness either personally or by post; and in either case a reasonable sum for travelling expenses is generally tendered with it. In civil cases such tender of expenses (usually one guinea) is obligatory on the party serving the writ, and if the tender is not made, the witness need not obey the *subpœna*, except under the conditions mentioned above. In criminal cases it appears that at the time of service a tender of expenses is not bound to be made, but a medical witness would be well advised always to obey the *subpœna*, claiming expenses later.

Obedience to the Subpœna. Where a *subpœna* is accepted and then ignored or disobeyed, the one who disobeys is liable to attachment by the court so flouted, or to an action for damages by the party serving the *subpœna*.

Attachment by the Court. Before any writ of attachment can be effected it must be shown clearly that there was contempt; that the defaulter was a material and necessary witness, was warned, and was duly called at the trial. If these formalities are complied with, it is in the power of the court to fine a defaulter or to commit him to prison until he has purged his contempt.

Actions for damages. Before such action can succeed it must be shown that the action in which the proposed witness was summoned was duly called on, and that the witness was both material and necessary. But it is not necessary to aver that the witness's absence was the sole cause of the failure of the plaintiff's action; but there must be actual loss through the witness's breach of duty to obey a *subpœna*.

Giving Evidence on Subpœna. All evidence (whether oral or documentary) falls into a category relating either to facts, or to opinions. The law deals more severely with criminal cases than with civil actions, and attaches more importance to *facts* than to opinions. In science, however, and in the medical sciences particularly, it is always difficult to distinguish between fact and theory; and if a doctor attends to testify to a medical or scientific fact, he cannot easily avoid giving an opinion arising out of the fact.

If a *subpœna* be sent to or delivered to a medical man, his course of action should in the first place be governed by the nature of the case (criminal or

[1] 7 C.B. (N.S.) 628 and 9 C.B. (N.S.) 881.
[2] *In re Working Men's Mutual Society*, 21 Ch. D. 831.

civil) and by the nature of the evidence which it is, or is supposed to be, in his power to give. The matter may be summarized as follows:

When he is summoned in connection with a criminal case, and has facts, including documents, in his knowledge or possession, he must obey the subpœna, regardless of the court to which he is called, and whether expenses are tendered or not. The most common case is a summons to a police court; and magis-trates have power to compel attendance.

In *Rich* v. *Pierpoint*[1] (an action for malpraxis), Lee was summoned, against his will, to give evidence on the part of the plaintiff. He stated that on the evening before the trial a solicitor called on him and left a *subpœna* with him. Lee would not hear an account of the case which the solicitor proposed to give, and said he would have nothing to do with the trial. The solicitor informed him that he would be required to pay the usual penalty if he did not attend. He went to Kingston, and was warned not to leave until the trial was over. He heard the evidence on the part of the plaintiff, and upon this, and the medical evidence, he gave his opinion, not much in favour of the party who summoned him and not much against him. He undoubtedly avoided further compulsion, if appearing a somewhat unwilling witness.

Where a medical man is served with a subpœna in a civil case, in connection with which facts are known by him, he should obey the summons, and give evidence as to the facts. If the solicitor neglects to tender expenses at the time of serving the *subpœna*, the witness should attend, and should leave the question of expenses to be dealt with subsequently.

Apart from the foregoing cases, difficulties arise where a medical man has received *subpœnas* to attend trials at two or more courts which are held at or about the same time, and obedience to both or all of them is impossible. On one occasion Taylor was called from a civil trial which had commenced in the Assize Court at Durham to a criminal trial which was fixed to take place on the same day at Lincoln; the civil case was postponed. In the opinion of one of the most experienced judges on the Bench, in all cases in which there are served separate *subpœnas* relating to trials fixed for the same time the civil case should give way to the criminal case. If, however, the *subpœnas* are for two criminal cases, a witness's best course is to attend the case in which the *subpœna* was served upon him first, and to address to the judge presiding over the second case a letter explaining the circumstances. The clerk to the court may be approached prior to the day set for hearing and he may explore the possibility of changing the order of cases. Final decision rests with the judge.

TAKING THE OATH

By the Oaths Acts of 1888 and 1909 a witness is allowed to give evidence without taking the usual oath and without "kissing the book." Unless the witness objects to taking an oath (in which case he may "affirm"), he should be sworn in the usual way by using the following words: "I swear by Almighty God that the evidence I shall give . . . shall be the truth, the whole truth, and nothing but the truth." Even if he profess to have no conscience, the taking of the oath effectually renders him liable to the law of perjury, which, next to the obligation of telling the truth, is the object of the oath.

Affirmation is given as follows: I, . . (name in full) . . , do solemnly and sincerely and truly declare and affirm that the evidence I shall give . . . etc. It does not lack dignity, and it achieves the same ends.

[1] 3 F. and F. 35.

EVIDENCE

Evidence given before a court may be of three kinds: viz., (i.) oral, (ii.) documentary; (iii.) real. The first mentioned must be dealt with at length, as it is the most common and often the only form in which medical evidence is given.

In the coroner's court, it is the common practice for the coroner alone to ask the medical witness questions bearing on the case; but, by his permission, any member of the jury or any other interested person may put questions, and these should be answered with fairness and candour. With this exception, the practice in all courts is the same, and a witness usually undergoes the following examinations:

1. Examination-in-chief, by the prosecuting or appellant counsel.
2. Cross-examination, by defending counsel.
3. Re-examination, by counsel examining-in-chief.*
4. Questions by the president of the court, or by the foreman or any member of the jury (through the foreman).

An accused person is always at liberty to go into the witness-box to give evidence on his own behalf, but, of course, may not ask questions from the box.

A medical witness must bear in mind that he should not allow his testimony to be influenced by the consequences which may follow from his statement of them, or their probable effect on the case. As to *opinions*, their possible influence on the result of the case should induce caution in forming them; but when once formed, they should be stated honestly and candidly without regard to consequences. It is well to remember, in regard to each stage of the examination, what a great medical authority has said:

"To make a show and appear learned and ingenious in natural knowledge may flatter vanity. To know facts, to separate them from supposition, to arrange and connect them, to make them plain to ordinary capacities, and above all to point out their useful applications, should be the chief object of ambition" (William Hunter).

Examination-in-chief. The ordinary course of proceeding in a criminal case is as follows: After opening the case, the counsel for the Crown calls the witnesses, and examines them according to the rules of evidence—that is, he brings out by questions *which do not suggest their answers* the facts relevant to the issue to be tried which are within the personal knowledge of the witness. When the examination-in-chief has been given, the next step is the cross-examination.

Cross-examination. In this, the second stage, the counsel for the accused seeks to extract from the witness, by leading questions, i.e. *those which suggest the answer in the strongest form,* any facts which may appear to be favourable to his client, and which he believes to be within the witness's knowledge. The theory of the law is that the witness is unfavourable to the side which is cross-examining him, and is therefore "hostile." The more he has shown himself, by conduct or conversation, to be partisan in the case, the more severely will he be treated. Anything which he may have said in the hearing of others, or published in journals, or even written in private letters (if the contents transpire), with reference to the case or the guilt of the prisoner, is now brought to light, although he may have supposed that what he did say was in confidence. It is at this stage of the case that any exaggerations which may have been most favourably received by the witness's own counsel are reduced

*The order will be reversed if the witness appears for the accused (the defendant). Cross-examination will then be undertaken by prosecuting (appellant) counsel.

to their true proportions. Any bias by which the mind of a witness may have been influenced, or any imperfection or confusion of memory as to facts, is here brought out. It is in this part of his examination that the medical witness will be closely questioned as to his qualifications, the time during which he has been engaged in practice, the accuracy of his judgment, his general professional knowledge, and his special experience with reference to the matter in issue, the number of cases which he has seen, etc. Straightforward answers should be given to all these questions.

In dealing with a skilled witness whose evidence may be of importance, the questions in cross-examination are usually put by the opposing counsel with great caution, for the answers brought out may be more adverse to his own case than those elicited in the examination-in-chief. The most important caution in cross-examination is the use of the phrase "I don't know." If a witness has once used it, let him adhere to it rigidly, and not be bullied by cross-examination into saying "It might have been."

Re-examination. As a rule, after cross-examination the witness is re-examined by the counsel who called him. The object of this is to clear up or to explain any part of the evidence which may have been shaken or rendered obscure by the cross-examination. It is sometimes unnecessary to put further questions; and if the witness has given his evidence consistently and fairly, he may be asked no further questions. As a rule, the re-examination must be confined to those matters which have arisen out of the cross-examination. Questions upon new matter may render a further cross-examination necessary.

Questions have been raised whether a witness should volunteer evidence where the examination-in-chief and cross-examination have not brought out all that he knows of the case. If what he has to state is some matter of fact within his own knowledge, or an opinion based on facts within his knowledge, he will be allowed, on application to the judge, to make the desired statement.

Questions by the Judge or by a Juror. There are no rules to govern such questions. The judge has absolute discretion in putting any question, as well as in allowing a juror to do so; as a rule, however, such questions should be simple, and only such as are necessary to clear up any small and doubtful point, although occasionally very important and far-reaching questions are sometimes so put. In a case of infanticide an Old Bailey judge once put this question: "Then, doctor, you mean there was no evidence of live birth?" "That is so, sir," came the reply, whereupon the judge stopped the case immediately without calling on the defence.

Such is the general method by which oral evidence is obtained, but some details of procedure must be noted.

PRIVILEGE OF COUNSEL

Medical men have sometimes complained of the abuse of the privilege of counsel. On this subject a high judicial authority has said: "The law trusts the advocate with a privilege in respect to the liberty of speech which is in practice bounded only by his own sense of duty; and he may have to speak upon subjects concerning the deepest interests of social life and the innermost feelings of the soul. The law also trusts him with a power of insisting upon answers to the most painful questioning, and this power again is in practice only controlled by his own view of the interests of truth."[1] It would appear,

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[1] *Per* Erle, C. J., in *Kennedy v. Brown*, 1862.

therefore, that almost unlimited powers of interrogation are entrusted by the law to counsel. Counsel should always exercise caution in putting a question. By putting the question he adopts it; although he may do so to the great damage of his own case. This seems at present to be the only check upon the practice; for judges seldom interfere, unless appealed to directly by the witness.

No witness is ever compelled to appear and testify to what he does not know. He may be compelled to attend in court in obedience to a *subpœna*; but if he attempts to give evidence as to technical matters upon which he is not competent, he has only himself to blame if things go wrong. A country practitioner may be called suddenly to a case in which a man is found dead from a wound in the throat. Notwithstanding the fact that a pathologist has also been called and has performed an autopsy which makes it desirable that questions on detail and on inferences to be drawn should be put to him rather than to the practitioner first called to the victim, the latter is bound over, *nolens volens*, to appear, for the first time, as a witness at a criminal trial, and may be asked (i) to testify to the fact that the throat was cut, and (ii) to state his opinion (*a*) as to the cause of death, and (*b*) whether the wound was inflicted by the deceased himself or by another person. The law assumes from his profession that the medical man made a proper examination of the wound, with a view to determining whether it was the cause of death, and whether it was or was not self-inflicted. It is difficult to understand how a medical man, although before this occurrence he may never have seen a case of cut throat, could excuse himself from giving answers to these questions, both of which involve purely matters of opinion. In medical evidence, facts and opinions cannot be entirely separated; and if medical practitioners were restricted in their evidence only to those facts which they observed, counsel would have little upon which to cross-examine.

Assuming that the witness is properly prepared for the discharge of his duties, and that the questions put to him are answered fairly and truly, according to his knowledge and experience, without exaggeration or concealment, he has nothing to fear from severe cross-examination. A doctor may always rely upon the judge to protect him from counsel desiring to take advantage of non-competence.

QUOTATIONS FROM BOOKS

A medical witness may reasonably be expected to have a fair knowledge of the writings of professional men on the subject of inquiry; and, during cross-examination, counsel occasionally refer to medical works. The authority is mentioned, the passage is quoted, and the witness may then be asked whether he agrees with or differs from the views of the author. If he differs therefrom, he is generally asked to state his reasons. In cases connected with medical treatment, the views of the profession are so various that a barrister has no great difficulty in finding a book containing opinions which differ from those of the witness. Standard works of recent date are so well known to the profession that there are few medical men engaged in practice who are not acquainted with, and are able to explain, the views of the writers, and who are unable to state how far such views agree with or differ from their own. The witness must be on his guard that the quotation is properly taken with the context, or he may find himself involved in a difficulty. If the witness is not already acquainted with the work, he should always ask to see the book in order that he may ascertain whether it is the current edition and that the passage is correctly or fully quoted.

Entirely without deliberate misrepresentation a barrister may, when dealing with the medical facts, misunderstand the author's views and may assign to the author opinions which he has quoted from other authorities. The medical witness should take care to put the matter in the correct light.

MEDICAL PRIVILEGE OR PROFESSIONAL SECRECY[1]

Some medical men have claimed a privilege not to answer certain questions which are put to them in a court of law, on the ground that the matters have come to their knowledge through private and confidential communications with their patients. The law concedes no special privilege of this nature to members of the medical profession. No man is bound to reply to any question if the answer would tend in any way to incriminate himself, for no man is compellable to be a witness against himself. With this exception, all questions must be answered, provided they are relevant to the case; and their relevancy is a matter for the decision of the judge. Sometimes a witness makes a frivolous objection or refuses to answer an ordinary question. The only result is to bring ridicule upon himself.

At an important trial an expert witness was asked his age. Instead of answering this simple question at once, he angrily appealed to the judge to know whether he was bound to give an answer on a matter which, he asserted, could have nothing to do with the case. The judge informed him that, unless he had some very strong reasons for concealing it, he had better state it.

At a trial for murder by poison, in the course of cross-examination, counsel for the prisoner asked the medical witness what remedy or antidote he had employed when he was first called to attend the deceased. He appealed to the judge to know whether he was bound to answer such a question as that. The judge said: "Yes, unless you have reason to believe that your antidote killed the deceased. In that case you are not bound to answer it." The question was answered immediately.

As there is no special privilege granted to members of the profession, a witness must remember that there are no medical secrets. In the case of the *Duchess of Kingston*[2] this privilege of withholding statements was claimed by a medical witness, but was not allowed by the court. In a case in which a woman was indicted for the murder of her infant, a surgeon was called to prove certain confessions made to him by the woman during his attendance. He objected to giving such evidence, on the ground that he was then attending her as a private patient. The judge ruled that this was not a sufficient reason to prevent a disclosure for the purposes of justice, and the witness was ordered to answer the questions.

Two sisters were servants to an old lady. One of them became pregnant, miscarried, and was attended by a surgeon. The mistress, who knew all about the matter, retained the girl in her service, and left her a legacy at her death. The will was disputed by the heir-at-law on the ground of undue influence; and at the trial, in order to injure the girl's character, the surgeon was called, and asked for what illness he had attended her some years before. Believing that he had a privilege, he refused to answer, but it was decided by Kindersley, V.-C., that he had no privilege, but was bound to tell all he knew.

In criminal cases the same point has arisen on many occasions; and it has even happened that the reply made by the accused to a question asked by his physician has been the only evidence upon which a conviction could be

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based. It will be seen, therefore, that any statements which are made to physicians or surgeons while they are attending persons in a private capacity, although not to be volunteered in evidence, must be given in answer to questions, whatever may be the consequences. Cases of poisoning, of wounding, and of abortion, as well as cases which involve questions of divorce or the legitimacy of offspring, may be affected materially by the answers of a medical man on matters which have been the subject of private communications. He cannot withhold such evidence.

The law of England on this important subject undoubtedly conflicts with the law of honour sought to be observed by medical men (from a breach of which more than one has suffered severely), viz., that information obtained in the consulting-room from patients relative to their ailments must be held to be inviolably secret.

In any case, however, where a medical practitioner is informed by a patient that a serious crime has been committed, it is his duty *at once* to communicate with the police. He may otherwise appear to condone it (see section on abortion).

The following case illustrates the difficulties in which a medical man may be placed by his peculiar confidential relations with his patients:

> An unmarried girl gave birth to a male child. The physician succeeded in placing it out, and a sum of £500 was paid with it. Before his death the physician told his son, who succeeded him in the practice, the whole circumstances of the case. The foster-mother took to drink, and the illegitimate son proved himself to be a "degenerate." He discovered from his foster-mother that he was not her own son, and also that the physician knew who his mother was. In his efforts to obtain, by threats, the name of his mother a free fight arose, and the son took out a summons for assault against the physician and foster-mother. At the hearing of this summons, the magistrate demanded to be informed of the name of the mother, which the physician refused to give; he lost his case.

Dr. Dixon Mann has said: "A good citizen obeys the law, although he may have scruples in doing so; therefore a witness should not set his private judgment against authority without very searching self-inquiry; an obstinate conviction must not be mistaken for a sense of duty. In the majority of cases it will probably be compatible with his sense of duty if the witness enters a protest against answering the question and then bows to the requirements of the law."

Venereal Diseases Clinics. It is clear from the requirements as to the notification of infectious diseases contained in Part V of the Public Health Act, 1936, that medical secrecy is not recognized by law. By that statute the medical man is compelled to disclose not only the fact of illness, but also the exact nature thereof.

> In the case of *Garner v. Garner*, the question was raised as to the obligation of a medical practitioner to give evidence of facts which have come to his knowledge while attending a patient at a venereal diseases clinic. The report of the case shows that it was at the patient's own instance, and on her behalf, that the physician who had attended her was called to give evidence as to her state of health. The physician drew the attention of the judge to the Venereal Diseases Regulations of July 12th, 1916, which required all information acquired by a medical practitioner in the course of his duties at a venereal diseases clinic to be regarded as strictly confidential; but the learned judge ruled that the witness was nevertheless bound by law to answer the questions put to him.

Diseases Regulations, the Ministry of Health has been advised that the obligation which the Regulations impose on the medical practitioner is not to disclose to third parties any facts which his examination of the patient may have brought to light. It would seem that a disclosure at the express request of the patient and in the patient's own interests would not be contrary to any principle of medical ethics.

The Venereal Diseases Regulations do not purport to, and indeed cannot, override the general law of England, which requires a witness in a court of justice to answer all such questions as the judge may hold to be relevant to the issue before the court.

Certificates of illness. Very much depends upon whether the practitioner is acting as a medical *officer* or only as a medical *man*. In the former case, it is, as a rule, a term of his appointment that he will give such certificates when acting for his employers; furthermore, those for whom the certificates are given know also that they will be given and read; and, therefore, a medical man is, in these cases, bound to complete a certificate accurately and precisely, stating the exact nature of the disease. The foregoing statement answers the following inquiry and many others of a similar nature which appear from time to time in the medical press.

"An engine driver came to consult me about an ordinary catarrhal ophthalmia, but in addition to this, I found unequal Argyll-Robertson pupils, absence of knee-jerks, and other slight symptoms of tabes, and possibly early G.P.I., tremulous tongue, nervousness, and some excitability, etc. Apart from this he was quite well and able to do his work. Would I be justified in reporting him to the railway company to prevent his working, as he himself did not see any reason why he should not do so?"

Some workmen's clubs will not give sick pay when incapacity arises from venereal disease. In such cases the medical officer must not in his certificate *suppress the facts; there can be no question here of professional secrecy.*

In private practice, many cases of difficulty may arise which require great nicety of judgment, of which the following is an example:

A child had interstitial keratitis, and a medical man was requested to give a certificate stating that the child could not attend school. The certificate required the nature of the illness to be stated. He refused to do this, but gave a general certificate to the effect that the child was not fit to attend school. As this was deemed insufficient by the school authorities, the mother was summoned. The medical man appeared as a witness for her in court; but he still refused to state the nature of the illness, and said that the child had an affection of the eyes. This action on the part of the school authorities was expensive to the ratepayers.

Certificates of incapacity to attend to public duties, such as army or jury service, are often given far too readily. A medical man should remember that in regard to such matters the doctor's reputation for honesty must not be forgotten. He is in a position of trust and responsibility and should act accordingly.

In this connection it should be remembered that *a certificate given by a medical man in response to the request of a private patient may possibly be used in judicial proceedings*, and the physician may be called upon to swear as to its correctness. His position would be very unenviable if he had subsequently to admit that the certificate was *not* correct.

In regard to the propriety of inserting in such a private certificate the precise causation (venereal, traumatic, etc.) of some symptomatic disease such as arthritis, each case must be judged on its merits by the practitioner's standard of conscience and duty. On the one hand, it has to be remembered

that the document is the private property of the holder, to be used or destroyed according to his discretion; on the other hand, the physician's reputation for honesty must not be forgotten.

The following case is in point:

A physician was called into consultation regarding the acute illness of a man who did not wish to serve for military duty. The trouble was gonorrhœal arthritis, and this was stated on the certificate. On appeal, the physician refused to delete the word "gonorrhœal". This refusal was based on two grounds: (1) public policy, in that if properly treated, gonorrhœal arthritis was perfectly recoverable, and the man could serve when he recovered; (2) the physician's own reputation, inasmuch as certificates of "rheumatism" are too readily given and are too vague to be of any use.

ADVICE TO MEDICAL WITNESSES

Some medico-legal writers have considered it necessary to formulate rules respecting (a) the manner in which a medical witness should give his evidence, (b) how he is to act on cross-examination, and (c) in what way he is to recover himself on re-examination. Any advice upon this head appears to be superfluous, inasmuch as experience shows that these rules, like those given to prevent drowning, are invariably forgotten at the very moment when the person concerned is in the situation when he requires them most. A man who seeks to the best of his ability to testify to the truth should bear in mind two things: (i) That he should be well prepared on all parts of the subject on which he is about to give evidence. Let him remember on these occasions the advice contained in the Latin motto, *Ne tentes, aut perfice*. (ii) That his demeanour should be that of an educated man, and suitable to the serious occasion upon which he appears, even although he may feel annoyed or irritated by cross-examination. A medical witness ought not to evince any resentment because his professional qualifications, his experience, his means of knowledge, or the grounds for his opinions are investigated very closely: rather he should prepare himself to meet with good humour the attempts of an opposing counsel to involve him in contradiction, and he should show, by his answers, that his sole desire is to state the truth. Law and custom have long established that a barrister, when defending a prisoner charged with murder, is entitled to make use of all fair, and even what may appear at the time to the witness unfair, means for the defence. Nothing can tend more to lower a witness in the opinion of the court and of the jury, or to diminish the value of his evidence, than the manifestation of a disposition to regard his examiner as if he were a personal enemy, to evade the questions put, or to answer them with flippancy or with anger. All such exhibitions end invariably in the discomfiture of the witness. It has been suggested that medical men upon these occasions might learn a lesson from lawyers, and observe how little they allow forensic differences, which they put on with their wig and gown, to influence them in their intercourse with each other, or with a perverse judge.

The following rules should be borne in mind, as they may result in the avoidance of many awkward positions.

1. *Have the subject-matter clear in your own mind.* An expert witness must be able to make the subject upon which he gives an opinion clear, and to give satisfactory reasons for this opinion. He must be able to satisfy others that he is master of the subject. Unless he has looked at the subject before with a purpose to understand it, comprehending its extent, weight, and relations, he will find it has suddenly assumed an importance he had not

suspected just at the time when the discovery will add to his confusion. Unless the subject is clear in his own mind, his account of it will be confused and unsatisfactory. Every man should submit himself rigorously to this test before entering the witness-box. The case should be viewed from all possible aspects; and if an opinion has been formed, it should be dealt with and criticised as if it were that of an adversary. As in controversy, a disputant should put himself as much as possible into the position of his antagonist and endeavour to see the question from that point of view.

2. *Give* DIRECT *answers to simple questions, and answer the question asked, whether the question be asked by your own or by the opposing counsel.* Medical witnesses are liable to forget that direct answers are necessary, and to give answers to questions which are floating in their own minds, or which they think are likely to be put to them. Some witnesses are also disposed sometimes to anticipate many questions by giving one general answer. This merely creates confusion; and the witness will be told by counsel to keep to the question, and that the other matters will be dealt with latter.

Most of the questions put by counsel in cross-examination will admit of an answer "Yes" or "No". If, from the ingenious or casuistical manner in which the question is framed, the witness feels that the simple affirmative or negative might mislead the court, then, after giving the answer, he should appeal to the judge to allow him to qualify it, or to add to it any matter *within his own knowledge* and which is relevant to the case. The witness must remember that he takes an oath to state the truth, *the whole truth,* and nothing but the truth. On the other hand, while the opposing counsel is bound not to introduce falsehood, his sole object is *not* the discovery or development of truth. Unless the witness is on his guard, he may find that when the learned counsel who has cross-examined him addresses the jury his affirmatives and negatives may be worked into a shape representing the reverse of what he intended.

Some witnesses have a habit of not answering the question which is asked, but one which is not asked. In regard to this practice, which arises, as a rule, from a lack of proper attention to the question, a judge once said: "When a witness does not answer a question, but answers something else, it leads persons accustomed to courts of justice to believe that he prefers not to answer the question, but to put a different point upon counsel".

Some witnesses begin to answer before the question is completed; or are concise from a fear of saying too much, whereas the answers of others are given in a voluble form, i.e., in the form of a little speech or lecture. A witness who is so profuse of information generally succeeds in supplying abundant matter for a long and tiresome cross-examination.

When a professional witness is giving evidence as to his opinion, it is not perjury for him to say "it was so-and-so", even if the contrary be proved by weight of counter-evidence; he will have made it clear that his evidence is only *his opinion* by saying "In my view . . . so and so".

No opinion should be given for which the witness is not prepared to assign reasons; and, except by permission of the court, no medical opinion should be expressed on facts or circumstances observed by others. A hesitating witness will be met with the question, "Have you any doubt about it?" or "Was it so or not?" to which a reply in the affirmative or negative must be given. If the witness fairly entertains doubts about the matter at issue, it is his duty to express them at once, and not to allow them to be extorted from him piecemeal by a series of questions.

Witnesses have occasionally testified to the discovery of "imperceptible", "unmistakable", or "undoubted" traces of poison in the liver and in other organs. Such terms naturally convey to the mind of the cross-examiner that the witness has some lurking doubt or suspicion of mistake in his mind. If poison has been discovered, the statement of the fact is sufficient, and where the quantity is known it should be expressed in figures.

3. *Beware of double or involved questions.* Sometimes counsel will compress two or three questions into one. In order to avoid answering the last question, or that which attracts his attention most, a witness should ask for a severance of the questions, and should give separate replies.

4. *Don't argue with counsel.* Argument is not evidence; and the entering into it disturbs the order of the proceedings. Arguments between counsel and witnesses, and even between medical witnesses themselves, are freely allowed in the French courts. but in England there is no such practice. The way in which questions are put by counsel in cross-examination sometimes tends to the introduction of argument, but the witness should avoid the temptation to enter into it. What he says in such circumstances is not evidence, except in the form of answers to questions; and he is there only for the purpose of stating what is relevant to the case.

Inasmuch as the judge is present to ensure, as far as possible, not only that the work of the court shall proceed with due order and decorum, but also that justice should be done to all, including the witnesses as well as the prisoner, a medical witness should appeal to the judge in every case where he considers that he has been asked an unsatisfactory question. The judge is the arbiter of what is and what is not fair, of what is and what is not evidence, of what questions the witness must and what he need not answer.

5. *Speak slowly, audibly and distinctly.* The jury must be able to hear clearly, and some of the jurors may be making notes. A judge generally takes full notes of the medical evidence; he has first to hear, secondly to understand, and thirdly to write down, the replies of the witness.

6. *Give your replies, as far as possible, in simple, non-technical language.* Some observations have been made above in regard to the use of technical terms in drawing up medico-legal reports. The unnecessary use of technical phraseology should be avoided. A medical witness should remember that when he is giving evidence he is speaking in the presence not of a medical assembly but of a jury of plain men and women who are probably ignorant of the meaning of many medical terms.

On a trial for an assault which took place at assizes some years ago, a medical witness informed the court that, upon examining the prosecutor, he found him suffering from "a severe contusion of the integuments under the left orbit, with great extravasation of blood and ecchymosis in the surrounding cellular tissue, which was in a tumefied state. There was also considerable abrasion of the cuticle". *Judge:* "You mean, I suppose, that the man had a black eye?" *Witness:* "Yes." *Judge:* "Then why not say so at once?"

In a case of child-murder a medical witness, who was asked to state simply the cause of death, said it was "owing to atelectasis and general engorgement of the pulmonary tissue".

If such language is employed by a medical witness with the view of impressing the court with some idea of his learning, it wholly fails of its effect.

7. *Avoid exaggeration.* The use of exaggerated language often leads to apparent conflict in medical testimony. If a part of the body is inflamed, it is frequently described by medical men as "intensely" inflamed. One

witness may speak of "patches of ulceration" in the intestines; whereas another may describe the same condition as "extensive ulceration".

A report should first be drafted roughly, and then simplified by striking out about 90 per cent of the qualifying adjectives and adverbs.

8. *Never lose your temper.* A barrister may sometimes try to make a witness lose his temper, in order to tempt him while in such a condition to make a rash or hazardous statement, but the judge can be relied upon to put a stop to discourtesy or bullying of witnesses.

MEDICAL EXPERTS

As regards the value of expert opinion in the coroner's court, the remarks on p. 28 are a sufficient exposition of the matter. The general consensus of opinion that only experienced pathologists should perform such autopsies, and that they should be adequately remunerated has now been supplemented by the Coroners Rules, 1953.

In criminal cases, and particularly in civil cases, the subject of expert medical opinion is of greater importance, and requires much consideration.

In questions of legitimacy or of divorce, obstetricians of high standing are consulted on both sides; in cases of insanity, those physicians who have acquired a reputation in the treatment or observation of the insane are chosen as witnesses; in cases of accident and life insurance, surgeons of repute and distinguished physicians are sometimes summoned as expert witnesses. Many of these cases could not possibly be settled without this collateral aid, inasmuch as the questions at issue are determinable only by persons of specialized experience.

The court has power to order that no more than a specified number of expert witnesses may be called. It is seldom that more than two are allowed in accident cases, although as was pointed out by du Parcq, L. J., in *Proctor v. Peebles*[1] there should not be a hard and fast rule, as in some cases the medical evidence must be all-important as to the nature and extent of the injuries sustained.

When invited to give evidence as an expert a medical man should arrange for a qualifying fee to be paid in any event, as the taxing master does not usually allow a very substantial fee when the fees are taxed after the case is over.

The more common objections to the expert medical witness appear to be the following:

An expert may be biased. Cockburn, C. J., in commenting upon expert evidence, observed that it was in the nature of things that those who gave scientific evidence should lean slightly to the side upon which they were giving their testimony, not from any dishonest intention, but from a perfectly natural and human failing, as in such cases a man was apt to look with a keener eye on those things favourable to his own side than those which were unfavourable.

Bovill, C. J., said: "The great misfortune or defect in medical testimony hitherto has been that medical men, like many other professional men, have been too much in the habit of making themselves partisans in endeavouring to support the particular views of the parties on whose behalf they have been called, and this has led to conflicts of opinion which have sometimes appeared not very creditable to the profession". This has undoubtedly been done by civil litigation.

An expert may act as medical adviser. Some barristers may obtain the services of medical men to advise them on the best method of cross-examining medical witnesses. Such advisers do not always go into the witness-box, and therefore cannot have their knowledge or experience adequately tested.

In addition to the fact that a practitioner who acts solely as medical adviser may have undue weight given to his suggestions by reason of their being put by his counsel as ascertained medical truths, he escapes that searching examination into his competency which is infallibly the lot of a medical witness; moreover, the latter is bound by his oath to state the *whole* truth, whereas the former is obliged to impart only so much of the truth as may suit the case of the party for whom he appears. In short, his position may be similar to that of a barrister who is not an advocate of any abstract principle of justice, but of the cause of his client. How far a medical man has a moral right to make use of his professional knowledge in order to embarrass the testimony of those of his professional brethren who are compelled by law to appear and to give evidence to the best of their ability on the other side is an ethical question which it is unnecessary to consider here. There can be no doubt, however, that whereas in some instances the practice may work well by preventing convictions based upon erroneous opinions, it is liable to be abused.

An expert has little or no opportunity for altering his opinion when fresh evidence is produced. An expert may honestly entertain a certain opinion when first consulted. The scientific witness who gives evidence for one of the litigants is generally expected to support his case under cross-examination, when many views may be suggested which may modify the witness's opinion; but even after proof of facts which ought to modify it the witness frequently adheres to his original opinion. Every witness should eschew altogether the notion of partisanship. He should be prepared to give his opinion frankly and unreservedly, regardless of results. He is there not as an advocate, but in order to inform the court to the best of his ability.

If, after hearing all the evidence, a medical witness finds the complexion of the case altered, and that he can no longer support the party calling him, it is his duty to himself and to his profession, as well as to the public, to withdraw from the case. No man should ever appear in court to support that which he does not believe to be true.

In 1938 a theological student murdered the pantry boy of his Oxford college by battering his head, strangling and assaulting him sexually. He endeavoured to conceal the body under the bed and then across the corridor in his locker but without success, finally disposing of it, naked, through a window on to the roof where it was found next morning. The student's guilt was all too obvious and, on arrest, it became apparent that he was not sane in the medical sense. Dr. R. D. Gillespie who was called by the defence to examine the state of mind of the accused stated that although there was no doubt that the accused was schizophrenic, his behaviour in concealing the body, his attitude towards the crime and his replies to questions on his feelings about planning the assault did not permit him (Dr. Gillespie) to give evidence in his favour under the McNaghten Rules. He asked Mr. Birkett to release him from any such obligation, and, of course, counsel accepted the position.

The present system leads to conflicting medical evidence. The conflict of opinion among medical witnesses and medical experts is a frequent subject of discussion by the public. In actions which involve the rights and duties of the clergy, there is seldom agreement among those who as ecclesiastical authorities have to decide upon them. It is similar among members of the legal profession, and in the administration of justice generally. Not only do

barristers frequently differ, and give conflicting opinions upon the same facts, but special jurors, consisting generally of intelligent men, are often unable to agree upon their findings, and have to be discharged without a verdict. The fact that occasionally scientific evidence may appear to be partisan does not justify the sweeping denunciation of medical or scientific witnesses as a body. As Mr. Justice Stephen said of the law, so it may be said of medicine.

"no system of rules can fully embody that line of conduct by the observance of which those who exercise a noble profession with honour and credit are distinguished from those who disgrace it. It is purely a matter of sentiment and good feeling; and it is truly a sad day for science, as one judge remarked, when the conflict of opinion may be traced to the ignoble motives of a desire of gain or of notoriety, or of anything but a desire for truth."

In civil cases it is not always easy to determine, until the evidence has been heard in court, whether scientific opinion is in favour of the plaintiff or of the defendant; and herein lies the great advantage to be gained by taking the opinion of scientific experts employed as assessors. There may be on each side a portion of the truth which will receive medical support without any imputation of wrongful motive. Nevertheless there are some simple matters of fact in regard to which members of the medical profession ought not to be in disagreement as for instance the fracture of a bone, the fact of which an X-ray photograph can prove beyond dispute, or the extent of a visible injury.

The proper duties of experts. Men of acknowledged skill and good professional experience sometimes forget their proper duties as experts. An expert is usually called to give an opinion on statements made by other witnesses; thus where certain appearances have been seen in the stomach or brain, the expert may be asked to state the conclusions to which such appearances lead. A general practitioner may describe accurately what he sees, but he may not have had sufficient specialized experience to draw a correct conclusion. Certain symptoms may be described which an expert may declare to be or not to be consistent with poisoning; but he must take care that he does not alter or distort the facts deposed to by other witnesses in order to fit into the case his own theories or opinions.

The duty of Experts in trials for malpraxis. Upon such occasions a witness is under a duty, when replying to questions by counsel, clearly and distinctly to state his opinion, together with the grounds upon which such opinion is based. It may be hard to condemn a fellow practitioner, but it would be harder still to ignore the public interest, and to condemn oneself and one's profession by concealing that which one knows to be true, or by suppressing what one honestly believes. A medical witness is under no duty to be urgent in pointing out or in suggesting defects, or in endeavouring to discredit another practitioner in the opinion of the public; but nothing should be concealed which is relevant to the elucidation of the case in issue. The golden rule, "Do unto others as you would that they should do unto you", should be strictly observed upon these occasions.

THE SELECTION OF MEDICAL EXPERTS

It is obviously impossible to exclude from a case all conflicting and bad medical evidence, inasmuch as either party may with reason feel aggrieved if he is not allowed to produce in court expert evidence in support of his case. Sound argument is healthy and tends to promote justice.

Medical experts should always be men of acknowledged reputation in the profession, not young in years or in experience. A large proportion are present or past teachers in medical schools who, from the nature of their duties, must keep themselves abreast of the discoveries of advancing medical science, and may be expected to be acquainted with new ideas.

Under the law relating to the care and treatment of persons of unsound mind, visits to institutions and to patients in single care are made throughout the country by barristers and physicians associated in pairs, the one trained in the investigation of law and facts, the other in the diagnosis of disease. This had worked admirably. In cases of alleged unsoundness of mind the presence of one or more of the physicians of the Board of Control, sitting with the judge and jury, would be of more value than the evidence of a shunerd ordinary medical men.

In regard to actions for damages in respect of injuries caused by railway accidents, it is enacted by the Regulation of Railways Act, 1868, s. 26, that—

"whenever any person injured by an accident on a railway claims compensation on account of the injury, any judge of the court in which proceedings to recover such compensation are taken, or any person who, by the consent of the parties or otherwise, has power to fix the amount of compensation, may order that the person injured be examined by some duly qualified medical practitioner named in the order, not being a witness on either side, and may make such order with respect to the costs of such examination as he may think fit."

Under the Arbitration Acts 1889, and 1934, the parties in a dispute may select an arbitrator, or each may select his own arbitrator, and these two arbitrators may then agree upon an umpire, in which case a tribunal is constituted which has power to call witnesses and to hear evidence. The particular advantage of such a tribunal lies in the fact that the three presidents, all of whom may be experts, allow the witnesses to be as technical as they wish. During the arbitration, technical terms may be used which are as familiar to the tribunal as to the witnesses, and the tribunal is able to decide the issues with a reasonable prospect of arriving at a just conclusion.

In the opinion of many this is a satisfactory way of disposing of civil cases in which medical evidence is the chief, if not the only, evidence upon which the decision must depend.

Under the Workmen's Compensation Acts, 1925 to 1945, medical referees were appointed to each county court in England and to each Sheriffdom in Scotland.

Sect. 38 of the 1925 Act provided for the appointment of legally qualified medical practitioners to be medical referees for the purpose of these Acts.

The First Schedule to the 1925 Act, par. 5, enacted that "a judge of county courts may, if he thinks fit, and shall, if any party, in accordance with rules of court, so requires, and gives security for the payment of the prescribed fee, summon a medical referee to sit with him as assessor."

Under the National Insurance (Industrial Injuries) Act, 1946, which repealed the Workmen's Compensation Acts in respect of accidents dated on or after July 5th, 1948, Medical Boards consisting of two or more medical practitioners were set up by the Ministry to assess *disablement* for benefit. In the event of dissatisfaction with that Board's decision the claimant may appeal to a Medical Appeal Tribunal consisting of a chairman and two medical practitioners. Doctors may also sit with the Local Appeal Tribunal whose function is primarily concerned with the working interests of employer and insured person.

Lastly, under the provisions of this Act, an Industrial Injuries Commis-

sioner who may determine legal questions which arise (together with a number of Deputy Commissioners who may be barristers and advocates of at least ten years standing) may call for the assistance of a specially qualified Medical Assessor.

DOCUMENTARY EVIDENCE

Documentary evidence in courts of law consists (*inter alia*) of:—

1. *Letters, Affidavits, Plans, etc., etc.*, with which the medical witness has absolutely nothing to do. These are purely matters of law, and need no comment here.

2. *Notes and Depositions*, about which sufficient has been said *supra*.

3. *Dying Declarations*. In general medical witnesses have no concern with documentary evidence other than dying declarations. Notes made by medical men are not evidence, and can only be used to refresh the memory of the witness who made them.

Dying declarations are the statements of a person who is actually dying and who believes he is dying. Very frequently, a medical man is responsible for obtaining such statements; for example, in accidents where death ensues rapidly. In those cases which prove fatal at some more distant period it is a medical man's duty to see that notice is given to the legal authorities in order that proper attention (presence of witnesses, etc.) may be given to the matter; moreover, it is his duty also to make a note of the mental as well as of the bodily condition of the patient at the time when the dying declaration is made.

The following rules apply in regard to the admissibility of dying declarations:

1. They can be used only in charges of murder or manslaughter.

2. They can be used only in trials for homicide in which the death of the person who made them was the subject of inquiry.

3. They can be accepted as evidence only as to the actual circumstances of the death, and for nothing else.

4. A dying declaration may be made orally or in writing, but, if the former, it must be written down by the person receiving it, either at once or as soon afterwards as possible; and also, if possible, it must be read over to the dying person and signed by him; or his assent and agreement must be obtained in some way.

5. The person making the declaration must be actually dying (*moribundus*, not *moriturus*).

6. He must *believe* that he is dying; but he need not believe that death will ensue immediately.

7. He must have no hope of recovery, and must *believe* recovery to be impossible.[1]

The fundamental principles upon which these rules are based are as follows: (*a*) It is obvious that, inasmuch as no cross-examination can take place on a dying declaration, it must, if admitted as evidence at all, be admitted as it was made; hence the law regards a dying declaration with a very jealous and scrutinising eye because it is an exception to the important rule that there must be an opportunity for cross-examination. (*b*) The law assumes that no one would willingly leave this world with a lie on his lips; that, under the sense of impending dissolution, all interest in this world is removed; and that the near contemplation of death has at least as powerful an effect upon the mind as the solemn obligation of an oath.

[1] *R. v. Perry* (1909) 2 K.B., 697 and *R. v. Austin*, 8 Cr. A.R., 27.

Duties of a Medical Man in Regard to Dying Declarations

1. He must inform the patient, as kindly as possible, that he is dying, and should ask him whether he wishes to make any statement. To tell the relatives is not sufficient. If the patient declines to make a statement, the medical man may then urge upon him the importance and advisability of making a statement, pointing out to him what use may be made of it in defending the innocent or in punishing the guilty. It is impossible to lay down any hard and fast rules; every practitioner must use his own discretion. If the patient desires to make any statement the medical man must then—

2. Observe very carefully the mental condition of the patient. When death takes place from violence, especially when loss of blood or a blow on the head is leading to death, delirium often supervenes or the intellect of the dying person becomes confused. If, therefore, the medical man observes any wandering or want of clearness in the mind of the patient, he must bear it in mind and should mention it in connection with his evidence; but this does not absolve him from his next duty, although it should make him particularly careful when writing his notes. It is necessary also to elicit from the patient what is his own opinion of his condition—whether he himself believes that he is dying, or whether he has some expectation of recovery.

3. The patient's statement should be written down immediately, or at the earliest opportunity after it has been made in the identical words used by the patient, carefully avoiding the practitioner's own interpretation of them or any paraphrases. The longer the interval which elapses between the time of hearing the words and the time of writing them down the greater is the possibility of error. If possible, after the statement has been written,

   (a) it should be read to the patient to ensure that it represents what he desires to say.

   (b) it should be signed by the patient.

   (c) it should be signed by any other persons present as being an accurate and complete account of what the patient said.

   In order to be admissible in evidence the dying declaration must be a complete statement on the face of it.*

4. In no circumstances should leading questions be put; and if at all possible, the questions asked, as well as the answers received, should be written down. As a rule, questions should be directed only to explaining what may appear ambiguous or contradictory in the statement of the patient.

5. In cases of longer standing, that is to say, where the patient has been ill for some time as a result of a criminal assault, it is the duty of the medical attendant to inform the police that the patient is dying, and to allow them to take the necessary steps to have any statement which the patient may wish to make taken down, signed, and witnessed in due legal form.

6. It is not his duty to form a judgment on the admissibility or otherwise of the declaration, provided he has noticed the mental condition as above; he must produce the statement just as it was made, and must leave it to the court to decide the question of admissibility.

   In all cases where a medical man perceives that the recovery of a wounded person is impossible, he should take the earliest opportunity for stating this opinion to the wounded person in the presence of others, so that the ends of justice may not be defeated by reason of the non-observance of these legal requirements.

* (*Waugh* v. *R.* Appeal Cases, 1950, p. 203)

In *R. v. Jenkins*[1] the prisoner was charged with the murder of a woman, who, on her death-bed, accused him of the crime. A magistrate's clerk attended her to take down her statement, writing down that it was made "with no hope of my recovery". He then read it over to her; but, before she signed it, she desired the addition of the words "at present", so that the words read "with no hope at present of my recovery". It was held that such statement could not be received in evidence as her objection to signing the statement without the words "at present" suggested some faint hope of recovery.

In *R. v. Morgan*[2] the wound was serious but no actual fear of immediate death was expressed by the victim. Death was caused by the prisoner cutting the throat of the victim. About five minutes before his death and when actually dying the victim made the declaration in writing, having at the time no power to speak. This was proved by a witness who saw the victim come staggering out of a hut with his throat cut. The declaration was admissible.

In *R. v. Abbott*[3] a woman who had taken poison, and who in the opinion of the physician was unlikely to recover, repeatedly ejaculated, while suffering great pain, "I'm dying." It was held that this did not conclusively show a fixed and settled belief in her impending death.

In *R. v. Ashton*[3] the deceased asked, "Shall I recover?" The surgeon said, "No." The patient grew better, but relapsed, and then repeated the question. The surgeon then said, "I think you will not recover." The deceased said, "I think so too." It was held that a declaration made after this conversation was admissible.

In *R. v. Mitchell*[4] the deceased was told by the physician that there was little or no hope of her recovery, and upon being asked whether she understood her position, replied that she did. It was held that there was no proof of a hopeless expectation of immediate death which would make her declaration admissible.

PRESENCE IN COURT

In England medical and scientific witnesses, except in special circumstances, are allowed to be present in court and to hear the whole of the evidence in the case. In some instances this is absolutely necessary if the court requires medical opinions; for, unless the witnesses are fully acquainted with the facts, they can give no opinions, and they can become fully acquainted with the facts only by being present and by hearing the evidence in court. If excluded, the judge or counsel will be compelled to read to the witness notes of the evidence before an opinion can be given, and it may appear subsequently that some small point is omitted which, if known to the witness, might have affected his opinion materially. A miscarriage of justice may take place when medical witnesses are excluded, and it is usually where there is no real defence or a false defence that the right of excluding them is exercised. The rule in Scotland is different; there medical witnesses are rigorously excluded from court during the hearing of other medical evidence. It is, of course, easy to imagine circumstances in which it might be advisable that a medical witness to *facts* should not be in court during the evidence for the other side, but such circumstances are not common.

FEES and ALLOWANCES to MEDICAL WITNESSES

The well-known statement that the labourer is worthy of his hire may, perhaps, cut both ways; but when consideration is given to the arduous and responsible duties of a medical man in the ordinary exercise of his profession—

[1] C.C.R., 187
[2] Cox, C. C., 337
[3] 67 J.P., 151
[3] 2 Lewin, C. C., 147.
[4] 17 Cox, C. C., 503

duties which frequently involve the question of life or death to a patient according to the promptness and skill with which such duties are performed—and in view also of the importance of the medical evidence in all cases where it is required, the fees allowed by law are still considered by many to be inadequate.

The Witnesses Allowance Regulations, 1918 effected some improvements in civil and criminal court cases, but coroners fees remain, as they were, inadequate.

In the Coroner's Court. By the Coroners (Amendment) Act, 1926, the fees payable to a legally qualified medical practitioner who has made a *post-mortem* examination at the direction or request of a coroner, or who has attended an inquest in obedience to a coroner's summons, are (with the exception stated below) as follows:—

(*a*) For attending to give evidence at any inquest one-and-a-half guineas for each day on which he is required to attend.

Sometimes Coroners ask practitioners to make reports in writing in order to enable them to decide whether an inquest is necessary. A practitioner is not legally bound to give such a report, but he would be well advised to do so. In most cases he will be paid a fee of 10s. 6d.

(*b*) For making a *post-mortem* examination of the body of the deceased and reporting the result thereof to the coroner without attending to give evidence at an inquest, two guineas. Certain travelling expenses are allowed by scheduled disbursements under local authority.

(*c*) For making a *post-mortem* examination of the body of the deceased (including the making of a report, if any, of the result thereof to the coroner) and for attending to give evidence at an inquest on the body, three guineas for the first day and one-and-a-half guineas for each subsequent day on which the practitioner is required to attend; travelling expenses may be claimed.

Provided that no fee or remuneration shall be paid to a medical practitioner for the purpose of a *post-mortem* examination instituted without the previous direction or request of the coroner.

In cases, however, where a coroner, in exercise of the power conferred upon him by s. 22 of the Coroners (Amendment) Act, 1926, requests a specially qualified person to make a *post-mortem* examination or a special examination, the foregoing provisions prescribing the fees payable to medical witnesses shall not apply; but the fees payable in respect of any such examination shall be such as may be described by the schedule of fees, allowances, and disbursements made by a local authority under s. 25 of the Coroners Act, 1887, or by rules made by the Secretary of State under the Coroners (Amendment) Act, 1926.

In Criminal Courts. As from September, 1918, there has been a sub-substantial improvement in the allowances payable to medical practitioners attending to give professional evidence in the criminal courts. Under the Witnesses' Allowance Regulations, 1918, which came into effect on that date, the maximum allowance to a witness to fact is £5 per day irrespective of whether the practitioner attends to give evidence in one or more cases, or whether the court is in the town where the practitioner resides or elsewhere. Where, however, the time during which the witness is detained away from his practice does not exceed four hours the maximum allowance is £2 10s., except in cases where he attends to give evidence in two or more separate

cases. In the latter event he may be paid allowances exceeding in the aggregate £2 10s. but not exceeding £5.

The regulations also provide for the payment of a night allowance to a professional witness where he is necessarily detained away from his home overnight for the purposes of attending court. The allowance for this purpose will be the expenses reasonably incurred by him for board and lodging, up to a maximum of £1 per night.

The travelling allowances, which remain unchanged, are as follows:

(1) The third-class railway fare (except where otherwise directed by the court). Where return tickets are available, the fare at the return rate only will be allowed.

(2) The fare actually paid where the witness travels by other public conveyance.

(3) Where no railway or other public conveyance is available: to a person who necessarily travels by a hired vehicle, the sum actually paid for the hire of the vehicle or an allowance at the rate of 1s. 6d. a mile each way, whichever is the less. (Where two persons attend from one place, the maximum of 1s. 6d. per mile shall apply unless the court is satisfied that the hire of two vehicles was reasonable).

(4) A sum not exceeding 3d. per mile to a person travelling on foot or by private conveyance.

The position of expert witnesses remains unchanged—i.e., they may be paid such allowances as the court considers reasonable having regard to the nature and difficulty of the case and the work involved.

It is the duty of the Taxing Officer to "ascertain the amount" of costs to be paid and he usually does so without reference to the Court, being guided by instructions contained in a circular issued by the Home Office to all Clerks of the Peace, Clerks of Assize and Clerks to Justices. This circular, which has no statutory force, originally stated that professional witness allowances should *not* be paid to salaried officers who do not lose remuneration by reason of attending Court.[1]

High Court and County Courts.

A member of either the medical or dental professions attending as a witness of fact either with or without subpœna is entitled in the High Court to a fee of from £2 2s. 0d. to £5 5s. 0d. per day. In the majority of cases a fee of £5 5s. 0d. per day is allowed on taxation to medical witnesses.

In the County Court medical men are treated as expert witnesses and not as witnesses of fact. Allowances to them range from £3 3s. od. to £8 8s. 0d. per day according to circumstances, plus in each case reasonable travelling and subsistence expenses.

The medical witness should remember that: —

(a) In criminal cases (as in the coroner's court) when once he has accepted a *subpœna*, he has no option whatsoever at any time subsequently; he must attend and give evidence under the above scale of fees.

(b) In civil cases, even after accepting a *subpœna, but before being sworn* and before he consents to give evidence, he should insist upon having in

writing an agreement as to his fees, both as to amount and as to the person who is to be responsible for payment. After taking the oath, he is subject to the rules of the court, and must give his evidence regardless of the prospects of receiving a fee, adequate or inadequate. Inasmuch as fees are recoverable only from principals, unless there is a special agreement to the contrary, a medical witness should take care in all cases where his attendance is required in a civil court to give expert evidence, that there is a special agreement in writing binding the solicitor who requires the attendance to pay the fees himself. A solicitor who serves a *subpœna* is not liable for the fees. In a case in which an action was brought against a solicitor for the amount of the fees it was decided that, as a rule, a solicitor is merely the agent of another person; and if he simply serves a man with a *subpœna*, he is not liable; for the witness's action for expenses is against the principal. This emphasizes the necessity for a special agreement.

(c) An *unregistered* medical practitioner, whatever his diplomas may be, is in exactly the same position as an unqualified "quack", so far as recovering fees by legal process is concerned; he may accept what is offered him, but can recover his fees only on an agreement *made beforehand* in the same way as any other person.

Fees. Wife as Agent for Husband. While a husband and wife are living together, it is a presumption of fact that the wife is agent for, and has the authority of, her husband to pledge his credit for necessaries supplied to their establishment which are suited to their station in life. A wife has implied authority to bind her husband for reasonable expenses for medicines and medical attendance incurred during illness; but this implied authority may be terminated if the husband gives sufficient notice that he will no longer be responsible for any debts which his wife may incur.

Travers v. *Sen*[1] was a case on the authority of a wife to pledge her husband's credit for fees for her accouchement. It was held that the wife had contracted only as an agent for her husband, and that an action could, in the circumstances, be brought only against him and not against the wife.

Fees for Calls by Police. When a police surgeon is called from his residence between 9 p.m. and 6 a.m. a fee of 25s. is paid, and when called out during the daytime for similar services a fee of 12s. 6d. is payable. *General Orders to Metropolitan Police* (1934).

Fees for Midwifery. The fees payable to medical practitioners who are called in by midwives in maternity cases are prescribed by Regulations made by the Minister of Health under the Midwives Act, 1936.[2]

Fees under the Road Traffic Act, 1934, s. 16. Where medical or surgical treatment or examination is immediately required as a result of bodily injury (including fatal injury) to any person caused by, or arising out of, the use of a motor vehicle on a road, and the treatment or examination so required is effected by a registered medical practitioner, the person who was using the vehicle at the time of the event out of which the bodily injury arose is under an obligation to pay to the practitioner, or, where such treatment is effected by more than one practitioner, to the practitioner by whom it is first effected—a fee of 12s. 6d. in respect of each person in whose case such treatment is effected by him; and a sum, in respect of any distance in excess of two miles which he must cover in order to proceed from the place whence

[1] 58 T.L.R., 582.
[2] 1940 S.R. & O., No. 602.

he is summoned to the place where such treatment is carried out by him and to return to the first-mentioned place, equal to sixpence for every complete mile and any additional part of a mile of that distance.

Fees for National Health Service are prescribed by Regulations.[1]

Recovery of Fees. With certain exceptions (e.g., Fellows of the Royal College of Physicians) medical men can sue for their fees according to a scale which varies with the social position of the patients visited, provided that the fees be fair and reasonable. In all professional dealings between medical men and their patients the customs of the profession will be considered as imported into the contract unless excluded expressly or by implication.

CHAPTER II

MEDICO-LEGAL RESPONSIBILITY IN THE EXAMINATION OF PERSONS ALIVE OR DEAD

Examination of the Living

THE varying conditions in which a doctor may be asked to make an examination of a living person for some medico-legal purpose—certification, insurance or other litigation, a complaint or charge of crime, abortion etc.—make some consideration of his responsibilities highly desirable.

A medical man acting in a private capacity, or a medical officer acting in an official capacity, may be called upon to examine: –

(i) An adult, capable of giving consent;

(ii) A child under age; incapable of consent by law.

(iii) A person incapable for reasons other than that of age of giving a valid consent—mentally confused, unconscious.

The person to be examined may be: –

(a) In the custody of the police, charged with an offence or crime;

(b) Not in custody, but suspected by the police;

(c) Neither in custody, nor even suspected by the police, but suspected or charged by other persons, e.g., employer;

(d) In a civil case, e.g., divorce, nullity, chastity, etc.

(e) A private patient, in the ordinary course of practice or in insurance work, etc.

It is worth while pointing out to medical men that although the fact that a visit is paid to a practitioner implies consent to a certain amount of examination, it must not be concluded that such a visit entitles the medical man to compel an examination more intimate than the patient desires. If, for instance, the physician considers a vaginal examination is necessary in order to complete his diagnosis, and the patient refuses her consent, he must not insist upon such examination. He should explain the manner in which this refusal prevents him from helping her, and how she is wasting her money and his time by consulting him at all. Beyond such expostulation, all that is said below as to judicial examinations holds good.

In all cases where an examination of the person is desirable, it should be made, because valuable evidence bearing on the case may be obtained from such examination. Delay may result in the evidence disappearing - fading or being washed away.

Consent. Two fundamental general propositions may be made: –

(1) Such an examination may be made only with the full and proper consent of the person concerned; if made without consent, it is technically an assault, and may possibly be an aggravated or even an indecent assault.

(2) In ordinary circumstances it is beyond the powers of a police officer,

coroner, lawyer, magistrate, judge, or even a bench of judges, to make a valid *order* for the medical examination of anybody's person.[1]

The following qualifications in regard to "consent" are made on the authority of decided cases, and of the dicta of judges:—

(a) Consent must not be obtained by fraud, nor by any undue moral pressure or duress; it must be given freely after a full explanation of the reasons for which it is desired, and of the consequences which may result from it. *Silence does not give consent*, nor is compliance necessarily to be taken as consent.

(b) In any case in which there could possibly be any doubt, the consent should be given in writing; and in all cases it should be given in the presence of disinterested witnesses, as otherwise there may be difficulty in proving it.

(c) Where the person is incapable, through age or through lack of understanding, of giving a valid consent, permission must be obtained from the parent or guardian.

(d) The medical man should ask himself the the questions: "Have I strong grounds for believing that an examination is really necessary for clearing up points which are vital to the case?" "Has consent been such that I could make it convincing to a jury if I were charged with assault?" In other words, he should have the support of his own conscience that he is acting with good reason and with valid consent.

Refusal to submit to an examination is by no means an admission of guilt. For instance, a prisoner may be suffering from venereal disease, and be unwilling that this should be disclosed, and yet may be innocent of the crime with which he is charged. If the complainant also has venereal disease this coincidence is not conclusive either way. Again, an innocent woman is just as likely or even more likely to refuse consent, as one who is guilty.

Furthermore, a desire to be examined must not be regarded at once as a proof of innocence. Men who commit crimes like rape, unnatural offences, etc., are frequently well aware of the importance of an examination as *prima facie* evidence in their favour, should it be negative, and it is easy for a criminal assault to be committed without leaving any trace upon the accused.

When consent has been obtained, the examination should invariably be made in the presence of a third party: neglect of this precaution has ruined more than one medical man of good repute.

Police Surgeons, i.e., medical practitioners acting in an official capacity, may be desired by police officers to examine persons in custody or suspected by the police; and they are sometimes asked to aid in detective work in cases where one or several women may be guilty.

The following is from the Police Orders issued to the Metropolitan Police entitled:—

Medical Examinations Cases Involving[2]

Sexual Offences etc Medical examination should be made of prisoners charged with such offences as rape, and Station Officers must see that the examination is made where a prisoner consents. It is impracticable to give a complete list of the

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[1] The right of search of the *clothing* of prisoners apparently stands on a different footing: a nice point might arise if a person were suspected of concealing stolen property in any of the natural passages of the body if a medical man were called to such a case he should obtain consent from the person suspected as well as written authority from those calling upon him for such assistance.
[2] The Editors gladly acknowledge their indebtedness to the Commissioner of Police, New Scotland Yard, for this information.

offences to which this order applies, but it includes unnatural offences, all felonies, and the misdemeanours under ss. 4, 5, and 11, Criminal Law Amendment Act, 1885, and all cases in which the examination seems likely to furnish evidence as to the prisoner's guilt or innocence.

Every prisoner to whom this order applies must be clearly told by the Station Officer, in the presence of the officer in charge of the case, that it is proposed to examine him, and that he has the right to object if he so desires. The examination must never be made under this order without the prisoner's *express* consent; for, in the absence of consent, any examination would be an assault.

If a prisoner consents to the examination, it must be made by the Divisional Surgeon, or, in his absence, by some other doctor called by Police, but the prisoner should be told by the Station Officer, in the presence of the officer in charge of the case, that if he desires the attendance of a doctor on his behalf, an opportunity for such attendance *jointly with the Divisional Surgeon, or other doctor called by Police*, will be given.

Arrangements are to be made for the examination to take place as soon as practicable after the prisoner is in custody and removed to the Station, and before he is taken before a Magistrate.

Every prisoner who requests examination by a private doctor is to be given clearly to understand that he will be responsible for the fee of the doctor attending on his behalf; and the private doctor, when called, is to be informed that his attendance is requested by the prisoner, who is solely responsible for his fee.

The officer in charge of the case will make an entry in his pocket-book (a) of every proposal for a medical examination, and of the prisoner's consent or refusal in his presence and (b) of the offer made to the prisoner to allow a doctor to attend on his behalf, and his acceptance or rejection of the offer. The entry will be initialled at the time by the Station Officer and will be available for the Court if necessary. The facts will also be recorded in the Occurrence Book by the Station Officer.

The Divisional Surgeon must make a separate entry in his private memorandum book and in the Surgeon's Report Book of the result of any examination, and he must be informed of the time and place where he will be required to give evidence before the Magistrate.

If, in addition to the Divisional Surgeon, or other doctor, called in the first instance by Police, the services of another doctor are obtained at the request of the Magistrate to make a further examination, the fee will be paid by Police.

These orders do not interfere with the customary police or other search of prisoners charged with felony, with a view to discovering evidence bearing on the charge, under another paragraph, nor do they interfere with the customary practice as to medical aid.

Other Offences. *Guiding Principles.* The following guiding principles must be very carefully borne in mind:

(1) A medical examination will take place only if expressly requested by a prisoner (or, with his consent, by friends) or when Police deem it necessary in the light of the ensuing instructions.

(2) Examinations on behalf of Police will ordinarily be made by a Divisional Surgeon. If a Divisional Surgeon is not available and the circumstances so require, the services of the nearest suitable doctor should be obtained, and references in these instructions to a Divisional Surgeon should be read as covering a doctor whose services are so obtained.

(3) Whenever a request for examination by a private doctor is complied with, the Divisional Surgeon will be called on behalf of Police.

(4) Divisional Surgeons and private doctors will be summoned *immediately* the necessity for medical examination arises.

(5) The examination by either doctor should take place as soon as possible after arrival at the Station.

(6) An examination by a private doctor will be conducted in the presence of the Divisional Surgeon, or, if he is not immediately available, in that of the Station Officer.

(7) A prisoner will be responsible for the fee of a private doctor attending at his request, and, if convicted, will be liable for the fee in respect of the *initial* examination by a Divisional Surgeon.

(8) A prisoner who appears to be drunk may be suffering from illness and/or may have sustained *injury which is not apparent*. In any case where the *slightest* doubt exists, the Divisional Surgeon is to be summoned immediately.

General Directions as to Examinations at a Prisoner's Request. In the case of a prisoner in custody for any offence other than those dealt with under sexual offences, in connection with which a personal medical examination may be material to the accused, if such examination is *expressly* requested by the prisoner or, with his consent, by friends, it will be made at the earliest moment practicable either by the Divisional Surgeon, or by any doctor attending on behalf of the accused. In the latter case the Divisional Surgeon will be called on behalf of Police.

A prisoner who requests examination by a private doctor is to be given clearly to understand that he will be responsible for his fee, and that, if guilty, he will also be liable for the fee in respect of the Divisional Surgeon's *initial* examination. He is to be informed at the time of making his request that the Magistrate will be asked to order payment by him of the Divisional Surgeon's fee if he is convicted. If he desires to pay the Divisional Surgeon at the time, he may do so, the particulars being included in the entry in the Occurrence Book.

In such cases when examination by a private doctor is requested, the Divisional Surgeon and the private doctor are to be summoned without delay, the latter being informed that his attendance is requested by the prisoner who is solely responsible for his fee. The examination by either doctor will take place as soon as possible after his arrival at the Station, and in no circumstances should an examination be delayed owing to the non-arrival of the other doctor. An examination by a private doctor will be conducted in the presence of the Divisional Surgeon (if in attendance at the time) or the Station Officer. If the *private doctor* completes his examination before the arrival of the *Divisional Surgeon*, he should be informed of the impending examination by the latter in order that he may, if he so desires, be present. If the Divisional Surgeon completes his examination before the arrival of the private doctor, he should be requested to wait a reasonable time for the examination by the private doctor. If, owing to delay in the attendance of the private doctor or other cause, the Divisional Surgeon has left the Station before the arrival of the private doctor, the Divisional Surgeon should be recalled or the services of ano her Divisional Surgeon secured, and meanwhile the prisoner should be examined by his own doctor in the presence of the Station Officer, and the doctor should be informed that the Surgeon has again been summoned and be invited to remain in order that he may, if he so desires, be present at the further examination by the Divisional Surgeon.

Each doctor will, on completion of his examination, be asked to certify his opinion in writing.

Any fee incurred in respect of a second or further attendance by a Divisional Surgeon in consequence of a prisoner's request for examination by a private doctor will be borne by the Police Fund.

The officer in charge of the Station will expressly enter in the Occurrence Book the request by an accused person for a medical examination, and the compliance with it, and report the facts.

(b) being drunk while in charge of a horse or a vehicle, other than a motor vehicle.

In the case of charges under (a) the attention of the doctor or doctors should be called to the actual terms of the charge and to the fact that they do not allege that the person is necessarily drunk.

In the event of a person charged with either of the offences specified in (a) or (b) being examined at his own request by more than one private doctor, an equal number of doctors, preferably Divisional Surgeons, is to be called on behalf of Police. In these circumstances a prisoner will be liable for the fee incurred for the initial examination by *each* doctor called on behalf of Police.

When a sailor, marine, soldier or airman is in custody of Police for drunkenness, etc., and he expresses a desire to be examined by a doctor and is willing to pay his fee, a doctor may be called to give an expression of opinion as to his condition, even if he is only detained for the arrival of an escort. If the doctor called is not the Divisional Surgeon, the latter must also be called on behalf of Police.

Special attention should be directed to the fact that full and free consent is essential; anyone who steps outside the limits of this written document does so at his peril, whether he be a practitioner called in by the police or a police surgeon.[1]

The following is a flagrant instance of overstepping the bounds of duty:—

A child was born in the street apparently from one of two women who were passing along; the child was taken in by a passing Samaritan; the two women went into a house in a street a short distance away. Next morning the police visited the house into which the women had gone, but the women had disappeared; the police traced them to another house, sent for the police surgeon, and, upon finding the women, requested the surgeon to examine the younger of them, using the expression to her: *"If you don't consent, I shall take you into custody."* The police surgeon thereupon examined her and found her a *virgo intacta*.

It is difficult to say who was the more deserving of blame, the police or the police surgeon, for both were violating every principle of justice, mercy, and decency, there being nothing but circumstantial evidence (which turned out to be misleading) to connect the woman with what, at its worst, was a doubtful crime; moreover, consent gained under a threat of arrest is not "free" consent.

In the case of a person in custody on a criminal charge there seems to be an absence of unanimity of opinion among the English judges as to the necessity for obtaining consent before examination; medical practitioners should take no risk over this.

In a case of unnatural offence tried at the C.C.C., a divisional surgeon of police was severely censured by the judge for not cautioning the prisoner as to the result of the examination, and for thus taking advantage of the prisoner's ignorance.

Requests to Examine Servants. Where a medical practitioner is called in by a private person to examine a maidservant or other employee of an age at which a valid consent is possible, special caution is necessary.

A medical practitioner who is so summoned should be careful to explain to the mistress that such examination can take place only with the free consent of the employee, that compliance does not mean consent, and that the result of the examination cannot be divulged without the consent of the person examined. It must further be remembered that since every person in employment is now insured under the Health Acts and has a medical attendant

of her or his own, it is desirable that any examination of such insured person should be made by the doctor on whose list she appears. If the employer wishes her own private practitioner to make an examination and the employee consents, the doctor of the insured person should be informed. The servant should be told the reason for the examination, assured that it is in her interest to clear up the suspicion, and informed clearly that it is for her to decide whether she will be examined or not. The following case is a warning to all practitioners who are consulted in such cases.

A housemaid, *æt.*28, was in the service of Captain and Mrs. B., who some time before the occurrence had been absent from home. Four days after their return, in consequence of some information given by a charwoman to Mrs. B., the latter came to the conclusion that the maid was pregnant, and told her to pack up and leave before 12 o'clock, as she was "in the family way". This the maid denied. Mrs. B. replied, "The doctor will be here directly", referring to the physician who, unknown to the maid, had been sent for previously. Mrs. B. told the maid to go to her room; the maid cried; Mrs. B. forbade her to speak. The maid went to her bed-room, and shortly afterwards the physician also came there. The maid cried, said that she had never had such treatment before, asked him what he was going to do to her, and said that she did not wish to be examined. There was some conflict of evidence between the maid and the physician whether she consented or not (which might have been avoided if the examination had taken place in the presence of a third person). The physician examined her, and found that there were no indications whatever of pregnancy, in spite of this, Mrs. B. dismissed her, and refused to give her a character. The maid brought an action against her master, mistress, and the physician. The case was tried at Manchester Assizes before Mr. Justice Denman; and, as the jury could not agree, they were discharged. It was retried at the following assizes before Mr. Justice Lindley, who withdrew from the jury the case against the master and mistress, as he considered that there was no evidence against them of the maid's non-assent upon which the jury could reasonably act, whereupon a verdict was found for the physician. But the case was not allowed to end there. The Vigilance Association assisted the maid in taking the case to the Court of Appeal, when the defendants were required to show cause why the verdict should not be set aside and a new trial ordered on the grounds that the learned judge ought not to have withdrawn the case from the jury, and that the verdict was against the weight of the evidence.

In the Court of Appeal, Brett, L. J., said:

"*I cannot conclude this judgment without expressing my abhorrence of the whole conduct with regard to this unhappy girl from beginning to end. I cannot conceive how right-minded people should, because they suppose—even if it had been true—that a young girl is in the family way, immediately take it into their heads that they are insulted. Why on earth should they have sent for the doctor? If they did not like to keep the girl, why not let her go away as quietly as possible? This idea of having servant girls examined by doctors is, to my mind, absolutely wrong, and it is conduct which everybody ought to scorn.*"

Examinations in Infanticide or Concealment of Birth.

Where the dead body of an infant has been found, and the police are endeavouring to find the mother, it may be necessary, in order to connect her with the birth of the child, to determine whether she has been recently delivered. Medical examination may show that the date of delivery does or does not correspond with the date of the birth and death of the child (*vide* Section dealing with the Signs of Delivery).

Medical men have no right to enforce an examination of a suspected woman, or, by threats or otherwise, of inducing her to be examined. Such a course of conduct is improper, for it is only when a woman willingly consents to be examined that a medical man is justified in *making an examination*. When a medical man takes this authority upon himself, and compels a suspected

woman, unwillingly, or under duress, to submit to a physical examination, he is forcibly compelling her to produce what may be positive proof of her guilt. The mischievous results of such officiousness are well illustrated by the following cases:—

A surgeon and an inspector of police insisted upon examining two women, a mother and daughter, in the absence of the husband and father, in order to determine whether either of them had been lately delivered of a child. This was against their wish and as a result of an action, damages were recovered.

In another case the dead body of a child had been found near the plaintiff's house. The defendant, a surgeon, went with an inspector of police to see the plaintiff's wife; and, having informed her that she was suspected of having had a child, told her that he had come to examine her by the authority of the law, and that she must submit. She refused at first, and proposed to send for a medical man whom she knew, but in the end the defendant examined her, and found that there was no ground for the charge. The jury awarded £200 damages for the assault.

In *Spicer v. Hall* it was alleged that Dr. Vincent Hall, knowing that Mr. Spicer was away in hospital, called at the house of Mrs. Spicer, and, after some conversation in reference to there being no children by her marriage, forcibly, and against her will, made an examination of her, which caused her much distress. Mrs. Spicer gave evidence in support of this allegation; but she admitted that she had not told her husband until later although she alleged that she had told certain women in the district. She could not fix the date of the alleged assault, but gave it approximately as being about thirteen months before the trial.

Dr. Vincent Hall said that he had called at a certain date upon Mrs. Spicer to inquire after her husband, whom he had sent into hospital, taking much interest in the case. Mrs. Spicer had some conversation with him about her childless condition, and asked if it were possible for her to have children. He told her he could not tell her without making an examination, which she then asked him to make. He demurred, stating that he could not do this without someone else being present; to which she objected strongly. After some further conversation, he consented to make the usual examination at her desire.

Dr. Hall was cross-examined; and other witnesses were about to be tendered by the defence, when the jury stopped the case, and a verdict was given for Dr. Hall.

The police can give no legal power to a medical man to make such an examination in a suspected case, and the ultimate consent of the woman, if extorted by threats or intimidations, will be no answer to a charge of indecent assault. A promise like "it will be better for you if you do" constitutes a threat.

In the following case the question of medical responsibility in cases of alleged infanticide was placed in a very painful light.

The coroner held an inquest on the body of a child in a case of alleged infanticide. A suspicion arose that a young lady, the sister of a clergyman, had been recently delivered. Two medical gentlemen, armed with a written order from the coroner, went to the rectory where she was residing, and requested an interview with her for the purpose of ascertaining whether she had recently had a child. She refused to see them, and subsequently took her life. The medical men, in endeavouring to justify themselves for the part which they took in the matter, relied upon the written order of a coroner.

In fact no coroner has authority to order the performance of an illegal act; and, if he should make such an order, it should not be obeyed. In the interests of the medical profession, and as a guide in future, the following legal opinion on the subject was obtained:—

"After diligent search on the subject of a coroner's authority, I entertain no doubt that an order for the physical examination of a woman, in a case of suspected infanticide and concealment of birth, is grossly illegal. Such a method of obtaining evidence is completely at variance with our principles of justice; and I can find no authority for it anywhere.

"The practice of searching persons in custody is simply a police regulation for

purposes of safety, to prevent suicide, and for the discovery of stolen property, and has no analogy to searching a woman's person in order to obtain evidence of concealment of birth.

"The coroner issuing such an order, and the medical man acting under it, would alike be liable to heavy damages in an action; and every surgeon acting under the orders of the police, or any other authority, is bound to see that the order is not in excess of their jurisdiction.

"Whether any, and if so what, change in the law on the present subject is desirable, is a matter not now in debate; but the question, whenever opened, will prove to be a very wide one."

Although no decision on this question may have been made by the judges, inasmuch as they denounce in the severest language the conduct of the police and of medical men in putting questions to and extracting incriminating answers from a woman charged with child-murder, they are not likely to spare a person who obtains from a woman by force or intimidation evidence of her criminality by a compulsory physical examination.

Examination of males charged with rape or indecent assault. Precisely the same rules of procedure apply in these cases.

In Boulton v. Park, a London police surgeon received a very stern rebuke from the judge for having examined one of the accused, while in custody, without having first obtained his consent. The learned judge told the witness that the prisoner would have been perfectly justified in knocking him down.

The danger of making **examinations without the presence of a witness** is illustrated by a case tried at Margate Quarter Sessions in 1903, when a sentence of six months' hard labour was awarded for assault; there was no corroboration of the testimony of the girl, who alleged that the examination was made without consent. By the Children and Young Persons Act, 1933, s. 38, the evidence of children of tender years must be corroborated by some other material evidence.

Special conditions are laid down for the examination of the person under the **Workmen's Compensation Acts and the National Insurance (Industrial Injuries) Act 1946.** Neither these cases nor any civil action for damages can give rise to any trouble to a practitioner who acts in accordance with the suggestions given above.

Examination of the Dead Body

For the examination of a dead body, or of human remains, no further authority than the written order of a coroner (or the Sheriff in Scotland) is required, or the consent, in non-judicial cases, of the nearest relative or guardian.

As to the "possession" of a dead body, and performing a *post-mortem* examination without consent, the law recognizes no property in a dead body except insofar as it belongs to the deceased's personal representatives for the purpose of disposing of it according to law. It is a misdemeanour (a) to prevent the burial of a dead body; and (b) to neglect to bury a dead body which one is legally bound to bury (e.g., that of a man's wife or child), provided that one is not legally bound to incur a debt for such a purpose. If a *post-mortem* examination be held without consent, no offence at law is, *ipso facto*, committed; it is only a moral offence against the relatives, which should, of course, be avoided.[1] No assault can be committed upon a dead body. Similarly, removal and preservation of organs is no offence. One or two actions

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[1] The provisions of the Anatomy Acts of 1832 and 1871 cannot reasonably be held to apply to a medical autopsy for it is not an anatomical dissection.

have been brought by living persons claiming portions of their anatomy, or pathological products, such as stones, which have been removed; judgment has always been entered for the claimant.

The safe rule is that a *post-mortem* examination may be made whenever the cause of death is known to be natural but cannot be determined in precise terms from the general and medical evidence. If a medical man cannot give a certificate of the cause of death, the body will pass into the control of the coroner. A medical man cannot legally claim a fee for what he has done without official authority, but, on the whole, it would seem that he should not, on the ground of professional secrecy, decline to divulge the knowledge which he had acquired at the *post-mortem* examination.

The line of conduct which a medical man should pursue is as follows:—

1. It is obvious that the cause of death was natural and the medical man desires a *post mortem* solely for his own professional information, he must obtain the permission of a responsible relative or guardian before acting; if another relative should object, the medical man would act more wisely by at once desisting, but if he still persists he is acting illegally only when he forces access to the body against the authority of the head of the house wherein the body lies; the *post-mortem* examination itself is not illegal in these circumstances.

2. If there be any doubt that the cause of death was natural, and the medical man cannot clear up the point without an autopsy, he would be wise always to report the case to the coroner.

He may however explain fully to a responsible person his reasons for desiring an autopsy, with the result that he may obtain permission to perform it. He is then entitled to perform it, because he is at that stage uncertain whether it will be necessary to inform the coroner: but if he has made an autopsy under these conditions he must not suppress any facts which he has acquired; and, if he finds evidence of unnatural death, he is bound to report the matter to the coroner. He will then almost certainly be criticized for not reporting the case, if at all obscure, at the start.

If permission to perform a *post-mortem* examination is refused the doctor should report the matter to the coroner, and should not touch the body until he has obtained a written order from that authority or from his deputy. Certification will rest with the coroner.

3. If the cause of death be unknown, it is not illegal to perform an autopsy with permission, and, if the cause of death is natural, the doctor can fill up the certificate without further delay. If it is *not* natural, however, the wisdom of embarking on an unknown course must at once be open to question. Better never to have started than to wreck all chances of an expert finding the cause of death. Second *post mortems* are notoriously difficult.

4. When once circumstances have arisen, whether before or after death, which necessitate a report to the coroner, a medical man must on no account touch the body for the purpose of an autopsy without the *written* authority of the coroner; to do so is to render himself liable to be prosecuted.

The following case shows how an aggrieved person endeavoured to make a *post-mortem* illegal by a somewhat frivolous use of the Anatomy Act:

A Dr. Carleton practising at Newnham was summoned to answer certain charges under the Anatomy Act of 1832. It was alleged: 1. That he, upon July 25th, 1904, being a person lawfully qualified to practise medicine, unlawfully did practise anatomy without having obtained a licence in pursuance of 2 & 3 Will. IV, c. 75, empowering him to do so. 2. That on the same date, being qualified to practise

medicine, he unlawfully did examine anatomically the body of John Price, without the permission or direction of the surviving wife. 3. That he did unlawfully carry on anatomy at a place to wit, the house of Emily Price, there situate, without having given at least one week's notice thereof before the first receipt or possession of the body for such purpose to his Majesty's Secretary of State for the Home Department.

The facts of the case were shortly these: John Price died of heart disease on July 23rd and Mr. M. F. Carter, coroner for the Forest Division of Gloucester, received a police report concerning his death. On July 24th Mr. J. W. Guise, who was acting as the coroner's deputy, received a communication from Dr. Carleton in reply to which he sent the following letter: "Dear Carleton, I did not know I was to hold an inquest to-morrow on poor Price. I have had no instruction myself from Mr. Carter to this effect. If, however, he tells you I am to, there is no doubt I shall do so. As to the necropsy, if you cannot arrive at the cause of death without one, please make it. It is my practice to leave these matters to the discretion of the doctor." On July 25th Dr. Carleton called at the house of the deceased; saw the body; and made a necropsy. There was a dispute as to whether upon this occasion Walter Price, a son of the deceased, did not ask Dr. Carleton whether he had any authority to make the necropsy. Dr. Carleton, in the course of his evidence, said that he acted upon the written authority given by Mr. Guise. The Summons was dismissed.

It is obvious that the Act was never meant to be applied to this offence, and it is doubtful whether a jury would ever convict.

A *post-mortem* examination may be ordered by the coroner without regard to any wish to the contrary expressed by the deceased or by his personal representatives. Apart from this statutory power of the coroner to order a *post-mortem* examination, any medical man is legally entitled to examine a dead body if he obtains the permission of the personal representatives of the deceased or other persons having lawful possession of the body, unless the deceased shall have expressed a desire that the body should not undergo examination, or unless the surviving husband, or wife, or other person having possession of the body shall require the body to be interred without such examination. Such persons should be apprised of the intended examination, and be given a reasonable time for objecting thereto. The near relatives have a right to object even if the deceased during his life directed that his body should be examined after his death.

CERTIFICATION OF DEATH

The doctor who has satisfied himself that death has, in fact, taken place has no duty to write any sort of edict to this effect; but he has a duty, if called to a dead body, to report the fact either by a certificate stating the cause of death (if he is in a position to give this) or to the Coroner or police (if he is not able to issue a certificate). He cannot merely certify the fact of death and walk away, for he is, by virtue of his having been called to the body, in the line of "informants".

A young casualty surgeon was called to the admission department of his hospital to see a man just brought in dead after collapsing in the street. He pronounced the body dead and returned to his other duties. Three days later the relatives went to the Registrar to ask what was going to happen as nothing had yet been done about the body. It was badly decomposed when it eventually came within the coroner's jurisdiction.

(a) There has been no professional attendance in life or during the last 14 days;

(b) The cause of death is obscure, possibly not natural;

(c) The cause of death may be a violent or unnatural one—or be associated directly or indirectly with injury, industrial exposure, poisoning—indeed, any unnatural event;

(d) Where there have been allegations of neglect or complaints in connection with treatment;

(e) Death is due to (or takes place "before full recovery from") anæsthesia;

(f) There is a statutory regulation enforcing a report to the coroner—as with deaths in prison, mental hospitals, foster children's homes, etc.

When once a case has been reported to the coroner the doctor has no further responsibility with regard to the death certificate.   It is the duty of the coroner to establish the cause of death.

DISPOSAL OF THE DEAD

Upon the death of a person it is the duty of an executor, a survivor in the family, or, failing either, of the local authority (National Assistance Act, 1948, s. 50) to bury or cremate the body. Funeral expenses rank for payments before debts (Administration of Estates Act, 1925, s. 34) or as now in England, come from the death grant under the National Insurance Act, 1946.

As there is no property in a body it cannot be disposed of by a will, but in general the deceased's wishes are observed; an expressed wish to avoid cremation is a bar to this method of disposal (Cremation Regulations, 1930).

Burial. For the purpose of burial a death must be registered by means of the Notice of an Informant and a medical certificate, and the Registrar's disposal certificate must be issued—except where, upon inquest, the coroner has himself issued an Order for Burial (Coroners' Rules, 1953).

No kind of disposal order from any person can be put into effect until a proper medical certificate of the cause of death, or a coroner's authority is available.

Cremation. The Cremation Regulations (1952) require: —

(a) Ordinary registration of death;

(b) Application for Cremation (Form A), verified by an approved person;

(c) Two medical certificates—one by the usual medical attendant (Form B), the other confirmatory (Form C);

(d) The Medical Referee's authority to cremate (Form F);

(e) Registration of Cremation (Form G) and Notification of Disposal thus to the Registrar.

A coroner may issue an authority (Form E) to cremate subject to the referee's approval, but he has no authority to request the cremation of unidentified remains (Cremation Regulations, 1930), and, indeed, such an order would be refused by the medical referee.

Cremation is so complete a destruction of the body that it destroys all traces of violence and all except radio-active poisons. The medical referee shoulders an important responsibility as a final authority for cremation.

before death, being certified (and confirmed) as dead from "cerebral hæmorrhage". There had been no autopsy.

The referee reported the matter to the coroner. Autopsy showed death to be due to morphine poisoning and the "nurse" (Waddingham) was later found guilty of murder. Exhumation of the mother of A. B. also revealed morphine.

Anatomy Act. A person may donate his body for anatomical dissection after death by the provisions of the Anatomy Act, 1832 and 1871—subject to prior requirements of the coroner—and an executor may also do so unless deceased or a surviving relative have expressed objection. This enables local authorities to supply bodies for purposes of medical education. A prescribed interval must elapse after death before any such disposal is carried out, and proper burial must follow within two years [Anatomy (England & Wales) Order, 1940, S.R. & O. No. 453].

Removal of Specimens. Where the coroner has assumed authority it is lawful to remove and retain any specimens provided this has his approval. No such authority exists for autopsies made merely with the approval of the relatives, but a very strict adhesion to this would prove impracticable, and a reasonable discretion is probably a better guide.

Stillbirths must be registered, but may then be retained together with the registrar's disposal order should it be decided to preserve them as specimens. They must ultimately be buried, but no period of time is prescribed. Corneal tissues may be used (Corneal Grafting Act, 1952) unless objection has been made to this in life or by the near relatives after death.

EXHUMATION PROCEDURE

At Common Law a coroner in England may order a body to be disinterred for an enquiry, provided the body lies in his district. If not, it is necessary for him to apply to the Home Secretary for an order under section 25 of the Burial Act, 1857. The Sheriff may grant a similar warrant in Scotland. Where suspicion has been raised as to identity or the cause of death, the Home Secretary may report the facts to the coroner and issue authority for exhumation.

The bodies of two children were exhumed by the Halifax coroner in January, 1951 on suspicion of homicidal poisoning. They had died in March, 1949 and October, 1950, under circumstances which had demanded the coroner's attentions but no grounds for action had arisen at the time. The death under obscure circumstances of yet a third child provoked more serious enquiry. Analysis showed someryl to be present in lethal quantity, but exhumation of the other two children gave negative analytical findings. No charge was made for lack of sufficient evidence against the mother.

During investigations into the case of *R. v. Christie* (C.C.C. 1953) public anxiety arose that his association with a man named Evans (who had been executed for the murder of his wife and child three years previously) might have resulted in a miscarriage of justice. Exhumation was effected shortly before the trial of Christie, but no new facts came to light.

The minister and church wardens (or the superintendent) of the cemetery must, of course, be informed, and it will be found convenient to screen off the grave and dig to within several inches of the coffin required the day prior to actual exhumation.

The procedure of identification, autopsy and the taking of samples are set out in the section dealing with the techniques of a medico-legal autopsy (p. 55). A coroner must issue a burial order anew, for he has to dispose of the subject of any inquest in this way.

During the investigations made by the War Crimes Commission after the World War II several hundreds of bodies of allied service men were exhumed for the purpose of establishing the identity and cause of death in order to prepare well founded "war crime" prosecutions. These required only War Office authority, though the Allied Graves Commission might re-inter.

Occasionally, as in the case of Rosetti, the poet, a request is granted for exhumation for the purpose of recovering papers or documents: poems of which he had no copy were buried at Highgate with his wife's body. In 1952 a Sheffield firm obtained an order for exhumation to examine records thought to have been buried with the founder of the firm.

Lastly, the disinterment of bodies may become necessary for replanning a district or changing the locus of a churchyard, and the local authority can empower this under the Town and Country Planning (Churches, Places of Religious Worship and Burial Grounds) Regulations, 1950.

For a more extensive review of the subject of disposal of the dead in its various aspects including details of cremation and embalming procedure the reader will find "The Disposal of the Dead" by Polson, *et al.*, a most useful reference.

Purchase, B., 1946. Jervis on Coroners. 8th Ed. Sweet and Maxwell, London.

Guest, W., 1943. The Pre-Raphaelite Dream. The Reprint Society. London.
    Originally published in 1942 by Jonathan Cape, under the title "The Pre-Raphaelite Tragedy".

Polson, C. J., Brittain, R. P., and Marshall, T. K., 1953. The Disposal of the Dead. English Universities Press, London.

HOW TO MAKE AN AUTOPSY FOR MEDICO-LEGAL PURPOSES

In almost every section of this work there is an expressed or implied necessity for a *post-mortem* examination of the body; it seems desirable, therefore, to give, once for all, some details of the procedure for such inspection in general, with observations on some special matters of more forensic interest.

In the first place, it is never too late to make an autopsy. No matter how far decomposition may have advanced, there is always a possibility of finding some material evidence necessary for the ends of justice. Bones, teeth, and hair are practically indestructible by decomposition, and other organs at times decay very slowly, and any of these may be useful for purposes of identification if for no other reason; moreover the discovery of foreign bodies, such as fragments of weapons, bullets, or other objects, may afford a complete elucidation of a mystery. Even fragmentary remains can provide much information.

The external appearances of putrefaction are often far in advance of the internal changes, so that they offer little indication for estimating what may be found by a complete inspection; certain poisons, such as arsenic, may exercise a certain local preservative effect. For these reasons no one should ever refuse to make a *post-mortem* examination on the ground that putrefaction is too far advanced.

The reasons why the body is examined may occasion a slight difference in procedure, but they should never afford an excuse for not examining it as thoroughly and completely as circumstances will allow. Inasmuch as it is impossible to foresee in what unexpected directions questions in court may lead, the second broad rule is: **Never be satisfied with less than a complete examination of the whole body and all the organs contained in it,** since it may be affirmed that a natural cause of death might have existed in that organ or cavity which the medical witness had neglected to examine.

If a mortuary is available an autopsy should never be performed in a dwelling-house, but, if it must be performed in the latter, the examiner should see that there is ample light for his purpose. It is a wise precaution never to attempt a *post-mortem* examination under poor conditions.

As a last general rule: Write down notes on the spot of everything which is found: the fact that the paper gets soiled will not destroy the value of what is written, but rather enhance it; for it is so far evidence of the truth of what is written, viz., it was written while facts were still fresh in the mind. Lengths and weights should never be guessed or left to the memory.

Instruments required. These are, or should be, provided by the authorities of the mortuary, but, as a precaution, the following should be included in a bag taken for the purpose: At least two good knives (5 and 10 in.) and a stout saw, a pair of scissors and bone forceps, together with needle and twine for sewing up the body. In addition it is well to have a steel tape, probes, and an extra pair of scissors with very fine points for cutting along smaller tubes of any sort, also toothed forceps. It is a wise precaution to take two or three clean wide-mouthed bottles of capacity about a pint, to contain portions of viscera or their contents, vomit, etc., smaller bottles or tubes for taking samples of hair, blood and urine, swabs, cellophane envelopes and a few microscope slides. Scales for weighing organs should be at hand if possible. If the case is one of suspected poisoning, sufficient chemically clean jars to take the whole of the viscera should be arranged for, together with labels and adhesive cellophane tape for sealing. A measuring cylinder and plastic catheter may be found useful, and it is as well to take spare rubber gloves and clean overalls in case these essentials have been forgotten by the authorities.

A camera is very useful, and might almost be included in the list of necessaries, especially when the body is that of an unknown person, or when there are special circumstances connected with the external appearances. The police authorities, however, generally concern themselves with such matters as taking photographs and finger-prints.

Identification. The body should be identified in the presence of the doctor who should make a note of the names and addresses of the persons who identify it. Clothing should be removed with care piece by piece, listed and laid aside separately, not bundled together.

It is essential to take notes on the points of identification where this is not known, not omitting the more obvious, such as sex, age, height, probable weight, colour of hair, teeth, etc.: Stains or dirt, either on the clothes or the person, may be of the utmost importance for reasons other than mere identification; it is, in fact, impossible to be too precise in writing down all these external details.

Autopsy. The body temperature per rectum, the extent and position of hypostases, the condition and extent of *rigor mortis*, and the state of putrefaction should be noted. These points may be of great help in fixing the time of death. The condition of the natural orifices – eyes, nose, mouth, ears, meatus of the urethra, vagina and anus – should be observed, and change from the normal noted. Samples of discharges should be taken on swabs or smeared on slides.

The next point is to make equally careful notes of the external inspection of the whole body for signs of violence, even of the most apparently trivial

nature. In order that nothing may be omitted, it is well to have a fixed order of observation— head and neck, trunk, arms, legs. The body must be turned over and the back examined.

This external examination may well be noted in two divisions: first, those marks which are probably not fatal in themselves, but which may throw great light on those that were fatal. The most important are:

Abrasions or bruises suggestive of violence: marks of finger nails.

Small cuts on the hands, etc., material caught in the finger nails.

Marks about the mouth (poisons) trauma—or neck. Petechiæ.

Marks suggestive of the use of a hypodermic syringe.

Burns, however trivial, and blistering.

Marks of powder grains or burns from firearm discharges.

All these require explanation of their presence, and they must be carefully considered in order to decide whether they suggest that a struggle has taken place. Remember that it may be as important to note their absence as their presence. The second division includes the more serious matters, such as:—

Fractured and dislocated limbs, lacerations and crushing injuries.

Cuts severing important structures— throat or wrists.

Stabs or punctured wounds.

Extensive burns or scalds.

Firearm wounds.

Any injury which, it is thought, might have some special significance should be photographed (with a scale laid alongside) or, if this is not possible, traced on transparent record paper. Any foreign matter, dirt, hair or metallic fragments in wounds should be carefully preserved. The doctor will be expected to know something, the pathologist *all* about them—when, how, by what means inflicted, etc., etc. It is impossible to enumerate everything that may be found, but the above remarks indicate the importance of noting everything.

The next point is the **interior inspection of the body**, or the *post mortem* as it is understood in ordinary cases of disease.

It is well to examine the cranial cavity before the abdomen or thorax is opened. A better chance is thus obtained of observing the condition of the intra-cranial venous channels as regards their fullness before they have had any opportunity of emptying themselves through a cut superior vena cava or jugular vein.

To open the head, the scalp is incised from ear to ear over the vertex, and reflected backwards and forwards from the incision. Any bruising of the deeper tissues of the scalp or damage to the bone will be noted. The skull cap is removed by sawing round the skull immediately above the level of the ears through the whole thickness of the bone: a chisel should not be used, for it may cause a new fracture or the extension of an existing fracture.

The condition of the dura is observed, after which it is cut away and the brain exposed.

After examining *in situ* the brain is removed by placing the fingers under the frontal lobes, lifting with gentle traction, and cutting the cerebral nerves at the base. The knife is passed around the attachment of the tentorium cerebelli, and after it is free the cord is cut as far below the medulla as possible and the brain removed.

The surface and base are examined for hæmorrhage, injury or disease, and the condition of the cerebral vessels, especially the circle of Willis, observed for the presence of arterio-sclerosis and minute aneurisms.

The brain is then incised to ascertain the condition of the deeper cortex, the basal ganglia and the ventricles. It is immaterial what method is adopted, but incisions should be so arranged that they never completely separate the section, in order that the whole brain may be reconstructed if desired. The pons, medulla and cerebellum must also be sectioned. For complete examination of the brain it is desirable to fix it in 5 per cent formalin, or other hardening agent, for a considerable time.

The membranes are stripped from the base and the bones examined for signs of fracture. Usually the site of a fracture will be indicated by hæmorrhage, but this is not always to be observed, and though the membranes are very difficult to remove, on no account should this precaution be neglected.

The presence and position of any hæmorrhage, injury or disease should be accurately noted, and in fractures the condition and thickness of the bones should be observed.

It is advisable to open up the middle ear and mastoid, and to investigate the condition of the frontal sinuses and antra in all cases in which there has been suspected infection.

The spinal cord must be exposed in local injuries and in any more obscure death.

It is not advisable to probe penetrating wounds of the brain. It is better to trace them by means of coarse sections, in such a manner that the brain can be refolded, i.e., the pieces are not actually severed from the bulk, but left attached to the meninges.

Having finished the examination of the brain, proceed to open the body in the usual way by a longitudinal incision from chin to pubis, with this special precaution, viz., that when dealing with a case of cut throat or wounds over any of the cavities of the body the incision should not interfere with the wound to be investigated, i.e., this wound should not become part of the incision. After this, care must still be taken that in reflecting the tissues from the chest or turning back the abdominal parietes the anatomical relations of skin, subcutaneous tissues, and viscera are disturbed as little as possible, for it is by preserving this relationship that one is able to trace the direction of a wound, which is often the most important element about it.

A warning has already been given against using a probe to track wounds in the brain: the same warning may be repeated here, but we are now dealing with tougher material than brain-matter. No more force than necessary must be exerted, for it may be asserted that the instrument, and not the original weapon, perforated the tissue. Dissection may then be carried on around the instrument, avoiding any interference with the external appearances. On no consideration should the weapon suspected to have been the casual agent be inserted into a wound to ascertain if it fits it.

The preservation of the external form will allow of a comparison being made at any future time between the edges of a wound and a weapon found on a suspected person. In the dissection every muscle, vessel, nerve, or organ involved in the injury should be traced and described. This will enable a witness to answer many collateral questions that may unexpectedly arise during the inquiry

It is advisable to remove the skin with any external wound and preserve it in formalin solution for future reference. All wounds must be carefully measured before preservation in case shrinking should occur despite precautions.

Now remove the sternum and ribs, preferably with bone forceps, for if a

saw be used it is apt to produce lacerated wounds of the viscera, and thus cause confusion between those produced by the violence before death and those produced by the saw; the differences are, in general, easy to detect, but that is no reason why matters should be needlessly complicated. The condition of the thoracic and abdominal viscera should be ascertained before anything is disturbed and any blood or other fluid or damage to any organ noted. If this precaution is not observed, the examiner is frequently in doubt as to whether any blood or damage to organs found later is a result of the dissection or whether it had previously existed. Air embolism is easily missed at this stage.

After careful dissection and examination of the superficial and deep tissues of the neck, the knife is passed around the inner side of the lower jaw to separate the attachments of the tongue, which is pulled down into the opening and by a few strokes of the knife it is reflected, together with the hyoid bone, pharynx, larynx, trachea and œsophagus from the posterior wall. This dissection gives a perfect view of the fauces and larynx, enabling any pathological condition to be readily recognized. The hyoid bone is examined for fractures, noting at the same time whether the cornua are ossified or not. The examiner must not be deceived by the natural joints between the body and the greater horns of the structure, and it will often be found of service to make an X-ray examination before attempting dissection.

The tongue should be examined for teeth marks and lacerations, and sliced into sections to ascertain whether there are any bruises in the deeper tissues.

The œsophagus, larynx and trachea are opened up and examined, and any ossification or fracture of the thyroid and cricoid cartilages noted.

As a rule it is better to remove the whole of the thoracic organs together with the tongue, larynx and trachea, but before this is done a ligature should be placed around the lower end of the œsophagus to prevent the escape of stomach contents.

The lungs are then examined, and the incision already made in the trachea is continued into the bronchi in order to detect foreign substances, froth, etc. Samples of this should be taken in suspected drowning.

The external aspect of the heart is examined, after which the left ventricle is transfixed at its base and the incision carried to the apex. The condition of the muscle and endocardium is observed, and after the aortic valve has been investigated from above the incision is carried up by means of scissors into the aorta, avoiding the cusps of the valves. The internal aspect of the aortic valve, the openings of the coronary arteries and the surface of the aorta are minutely examined, the coronary arteries are sliced at very short intervals and examined for signs of sclerosis and partial or complete occlusion. The left auricle is then opened and the state of the mitral valve observed. The right side of the heart is similarly treated.

The uterus, with its connections, and the vagina must be examined for signs of injury, abortion, infection, etc.: a wedge may be removed from the pubis for this purpose.

The bladder is examined after removal of its contents.

The urine should be taken for examination for sugar, albumen, blood, pus, alcohol, etc., the presence of which may throw considerable light on an otherwise obscure case. (See Vol. II.)

It is well also to take a good sample of blood from the chambers of the heart for examination when necessary for alcohol, volatile poisons, carbon monoxide, etc.

The fact that several days have elapsed since death will not prevent the discovery of food in the stomach, provided it had been taken within one or two hours before death, since the digestion of food does not appear to go on to any considerable extent after death. We have identified food in the stomach twelve months after interment, and identifiable vegetable food was also found in the stomach of the "Tollund" man, dug up mummified in 1952, from burial in peat in Jutland 2,000 years previously. The kind of food present and the state of its digestion has proved of importance in numbers of criminal trials (*vide* "How Long Dead").

In examining the abdominal organs it is worth while to draw special attention to the fact that colour changes are very frequently found in those which lie close to the liver (kidney, stomach, duodenum, etc.), owing to the fact that the colouring matter of bile easily permeates the tissues. These colour changes must not be mistaken for signs of inflammation, or of putrefaction. If inflammation be present either pus or lymph will be found, the latter leading to sticky adhesions, or at least to a loss of lustre of the peritoneum. Hypostasis may also mislead an inexperienced investigator.

Post-Mortem digestion of the stomach is a common phenomenon but perforation from such digestion is less often seen. The reason why the stomach is sometimes perforated by autodigestion and sometimes not is not at all clear. *A priori* one would expect autodigestion in those cases where the stomach was healthy and actively digesting when death took place, but experience in the *post-mortem* room has shown that such is by no means invariably the case, for autodigestion has been seen in cases of lingering disease, and it has not been observed in many cases of accidental sudden death.

When all the organs have been carefully examined and notes made on them, it must be remembered that these notes only form the material for a report; the report itself must be carefully drawn up in order—first facts, then inferences if required (*vide* p. 5). This should be done with as little delay as is practicable.

Post-mortem Infections. If the operator should prick his finger or otherwise wound himself during the performance of an autopsy, he should at once take steps to prevent infection. He must stop the autopsy immediately, remove his gloves, and hold the hand or injured part in warm (not hot) water for several minutes. Bleeding must be encouraged to wash out the wound, and if this does not take place freely by placing the hand in warm water, the arm should be swung to produce a congestion and the tissues squeezed. After allowing free bleeding and washing for five minutes tincture of iodine may be applied and the finger bandaged. The member must be carefully watched for the next day or two in order to take prompt steps if

there should be the slightest sign of infection. If local or systemic evidence of infection does develop, appropriate local measures and adequate chemotherapy should be instituted immediately, under directions from a surgeon.

PROCEDURE AT EXHUMATION

The authority for exhumation has been described in the section (p.48) dealing with the disposal of the dead. In the following pages we will set out the practical procedure at the graveside and in the mortuary as they concern the police officers and the pathologist.

First, though some privacy is most desirable, absolute secrecy is seldom attained; to creep into a burial place at night and work at the disadvantage of darkness is crass stupidity. News reporters are better treated firmly than by deception, and can be left to the senior police officer for statements on what is taking place.

As to who may be present the discretion of that officer is the best guide. Any doctor who has attended the subject in the last illness, any pathologist who has previously made an autopsy, or who has been requested to make this one, or who has been asked by solicitors to represent a party under suspicion may ask the senior police officer's permission to attend. All who have some duty to perform (see below) must also be present.

The exhumation is best done soon after dawn, a suitable screen having been erected and the coffin approached (to within 3 or 4 inches) the day before.

The superintendent of the cemetery (or church warden of a churchyard) should identify the burial place from the records and the undertaker should be at hand to identify the coffin. A sexton or grave-digger may confirm this identification procedure, and relatives may also identify either the coffin or the body.

As the coffin is raised the pathologist should take samples of earth (or water) from just above and on each side (and later from underneath) the coffin, labelling each with care himself. To leave such matters to anyone else is risky. If water drains out of the coffin a sample should be collected. The coffin should be taken to a mortuary if possible before it is opened.

The undertakers should then remove the lid, preferably on trestles alongside the autopsy table, and identification should again be made by those who placed the body in the coffin. The coroner may now view the body. A large selection of jars, tubes, cellophane bags, labels and swabs should be close to hand, and as each step is taken it should be dictated to someone who repeats it back for check. No trouble is too much, for accuracy is essential.

The details of the next stage, that of examining the body, are dictated by its condition and the specific purpose of exhumation. The procedure does not differ in essentials from a medico-legal autopsy of any other kind.

Lastly, full reports of the details, containing all relevant dates, times, persons assisting, identifying, etc., and of the autopsy findings must follow at a reasonably early date. They should be communicated only to the coroner and the senior police officer and no information of any kind should be given to the press or any member of the public.

Before leaving the mortuary a pathologist should assure himself that his examination has been complete and that he has taken all specimens which may be required for later examination. He must remember that it will not be possible to have any re-examination of the remains in many cases.

CHAPTER III

FUNCTIONS OF THE GENERAL MEDICAL COUNCIL

THE General Medical Council was originally constituted by the Medical Act of 1858. It deals with the registration of medical practitioners, the publication of the *British Pharmacopœia*, the exercise of disciplinary powers over registered medical practitioners and the standard of medical education. Its disciplinary functions are those which are of interest from a medico-legal aspect. Those functions are set out in Sections 26 and 29 of the Medical Act of 1858. Section 29 provides that if any registered medical practitioner shall be convicted in England or Ireland of any felony or misdemeanour, or in Scotland of any crime or offence, or shall, after due inquiry, be judged by the General Medical Council to have been guilty of infamous conduct in any professional respect the General Medical Council may, if they see fit, direct the Registrar to erase the name of such medical practitioner from the register.

The definition of infamous conduct in a professional respect was laid down by Lord Justice Lopez in *Alison* v. *General Medical Council* (63 L.Q.B. 534):—
"If it is shown that a medical man in the pursuit of his profession has done something with respect to it which would be regarded as *disgraceful or dishonourable* by his professional brethren of good repute and competency, then it is open to the Council to show that he has been guilty of infamous conduct in a professional sense".

The disciplinary functions originally exercised by the General Medical Council are now by virtue of Section 14 of the Medical Act of 1950 exercised by the Medical Disciplinary Committee, consisting of the President of the Council and 18 other members. The constitution of the General Medical Council is laid down in the Medical Act of 1858, and various other amending statutes or orders in Council. The procedure of the Disciplinary Committee is set out in Section 16 of the Medical Act of 1950. At any enquiry before the Disciplinary Committee the medical practitioner may be legally represented. No precise definition of infamous conduct has ever been or could be attempted. Each case is considered upon its facts and the general principles can be deduced from the case previously quoted of *Alison* v. *General Medical Council* and by a series of subsequent decisions of the Council and of the Courts. An appeal lies from an order of erasure to the Privy Council by virtue of Section 20 of the Medical Act of 1950. In order to help medical practitioners the General Medical Council have issued Warning Notices indicating certain kinds of conduct by medical practitioners to which the Council are likely to take exception. The main points of such Notices are as follows:—

Disciplinary jurisdiction over registered medical practitioners was conferred upon the General Medical Council by section 29 of the Medical Act, 1858, which, as amended by section 18 (1) of the Medical Act, 1950, is as follows:—

"If any registered medical practitioner shall be convicted by any court in the United Kingdom or the Republic of Ireland of any felony, misdemeanour, crime or offence, or shall after due inquiry be judged by the General Council to have been guilty of infamous conduct in any professional respect, the General Council may, if they see fit, direct the Registrar to erase the name of such medical practitioner from the Register."

The Medical Disciplinary Committee of the Council have decided to adopt the long established practice of the Council by circulating for the information and guidance of practitioners a Notice containing particulars of judgments and decisions of the Council on disciplinary cases which were from time to time brought before them.

It must be clearly understood that the particulars which are given below do not constitute, and are not intended to constitute, a complete enumeration of the professional offences which may entail erasure from the Register; and that by issuing this Notice the Committee are in no way precluded from considering and dealing with any form of professional misconduct (as, for example, adultery, committed in professional relationship) which may be brought before them, although it may not appear to come within the scope or precise wording of any of the categories set forth in this Notice. Circumstances may and do arise from time to time in relation to which there may occur questions of professional conduct which do not come within any of these categories. In such instances, as in all others, the Committee have to consider and judge upon the facts brought before them.

1. Certificates, Notifications, Reports, etc.

Registered medical practitioners are in certain cases bound by law to give, or may be from time to time called upon or requested to give, certificates, notifications, reports, and other documents of a kindred character, signed by them in their professional capacity, for subsequent use either in the Courts or for administrative purposes.

Such documents include, among others, Certificates, Notifications, Reports, etc.

(a) Under the Acts relating to births, deaths, or disposal of the dead;

(b) Under the Acts relating to Lunacy and Mental Treatment, and Mental Deficiency, and the rules made thereunder;

(c) Under the Factory Acts and the Regulations made thereunder;

(d) Under the Education Acts;

(e) Under the Public Health Acts and the Orders made thereunder;

(f) Under the Acts and the Orders relating to the notification of infectious diseases;

(g) Under the Family Allowances Act, National Insurance (Industrial Injuries) Act, National Insurance Act, and National Health Service Acts, and the Regulations made thereunder;

(h) Under the Old Age Pensions Acts and the Regulations made thereunder;

(i) Under the Merchant Shipping Acts;

(j) For procuring the issue of Foreign Office passports;

(k) For excusing attendance in the Courts, in the public services, in public offices, or in ordinary employments;

(l) Under the National Service Acts, or in connexion with persons serving in His Majesty's Forces;

(m) In connexion with matters under the control of the Ministry of Pensions.

Any registered medical practitioner who shall be proved to the satisfaction of the Committee to have signed or given under his name and authority any such certificate, notification, report, or document of a kindred character, which is untrue, misleading, or improper, whether relating to the several matters above specified or otherwise, will be liable to have his name erased from the Register.

2. Unqualified or Unregistered Assistants and Covering. The employment by any registered medical practitioner in connexion with his professional practice of an assistant who is not duly qualified or registered, and the permitting of such unqualified or unregistered person to attend, treat, or perform operations upon patients in respect of matters *requiring professional discretion or skill*, is in the opinion of the Committee in its nature fraudulent and dangerous to the public health; and any registered medical practitioner who shall be proved to the satisfaction of the Committee to have so employed an unqualified or unregistered assistant will be liable to have his name erased from the Register.

Any registered medical practitioner who by his presence, countenance, advice, assistance, or co-operation, knowingly enables an unqualified or unregistered person, whether described as an assistant or otherwise, to attend, treat, or perform any operation upon a patient in respect of any matter requiring professional discretion or skill, to issue or procure the issue of any certificate, notification, report, or other document of a kindred character (as more particularly specified in paragraph 1 hereof), or otherwise to engage in professional practice as if the said person were duly qualified and registered, will be liable on proof of the facts to the satisfaction of the Committe to have his name erased from the Register.

The foregoing part of this paragraph does not purport to restrict the proper training and instruction of bona-fide medical students, or the legitimate employment of dressers, midwives, dispensers, surgery attendants, and skilled mechanical or technical assistants, under the immediate personal supervision of a registered medical practitioner.

3. Sale of Poisons. The employment for his own profit and under cover of his own qualifications, by any registered medical practitioner who keeps a medical hall, open shop, or other place in which scheduled poisons or preparations containing scheduled poisons are sold to the public, of assistants who are left in charge but are not legally qualified to sell scheduled poisons to the public, is in the opinion of the Committee a practice professionally discreditable and fraught with danger to the public, and any registered medical practitioner who is proved to the satisfaction of the Committee to have so offended will be liable to have his name erased from the Register.

4. Dangerous Drugs. The contravention by a registered medical practitioner of the provisions of the Dangerous Drugs Acts and the Regulations made thereunder may be the subject of criminal proceedings, and any conviction resulting therefrom may be dealt with as such by the Committee in exercise of their powers under section 29 of the Medical Act, 1858. But any contravention of the Acts or the Regulations, involving an abuse of the privileges conferred thereunder upon registered medical practitioners, whether such contravention has been the subject of criminal proceedings or not, will, if proved to the satisfaction of the Committee, render a registered medical practitioner liable to have his name erased from the Register.

5. Association with Unqualified or Unregistered Persons. Any registered medical practitioner who, either by administering anaesthetics or otherwise, assists an unqualified or unregistered person to attend, treat, or perform an operation upon any other person in respect of matters requiring professional discretion or skill, will be liable on proof of the facts to the satisfaction of the Committee to have his name erased from the Register.

6. Advertising and Canvassing. The practices by a registered medical practitioner—

(a) Of advertising, whether directly or indirectly, for the purpose of obtaining patients or promoting his own professional advantage; or, for any such purpose, of procuring or sanctioning, or aquiescing in, the publication of notices commending or directing attention to the practitioner's professional skill, knowledge, services, or qualifications, or depreciating those of others; or of being associated with, or employed by, those who procure or sanction such advertising or publication: and

(b) Of canvassing, or employing any agent or canvasser, for the purpose of obtaining patients; or of sanctioning, or of being associated with or employed by those who sanction, such employment,

are in the opinion of the Committee contrary to the public interest and discreditable to the profession of Medicine, and any registered medical practitioner who resorts to any such practice renders himself liable, on proof of the facts to the satisfaction of the Committee, to have his name erased from the Register.

7. Association with Uncertified Women Practising as Midwives. Whereas it has been made to appear to the Council that certain registered medical practitioners have from time to time, by their countenance or assistance, or by issuing certificates, notifications, reports, or other documents of a kindred character, enabled uncertified persons to attend women in childbirth otherwise than under the direction and personal supervision of a duly qualified and registered medical practitioner, as required by law;

And whereas such conduct is in the opinion of the Council and of the Committee discreditable to the profession of Medicine, and calculated to defeat the purpose of the statutes made in the public interest for the protection of mothers and infants;

Notice is hereby given that any registered medical practitioner who is proved to the satisfaction of the Committee to have so offended will be liable to have his name erased from the Register.

The Council point out that it must be clearly understood that the instances of professional misconduct which are given do not constitute, and are not intended to constitute, a complete list of the offences which may be punished by erasure from the Medical Register; and that by issuing the Notice they are in no way precluded from considering and dealing with any form of professional misconduct (as, for example, immorality involving abuse of professional relationship) which may be brought before them, although it may not appear to come within the scope or precise wording of any of the categories therein set forth. Circumstances, may, and do arise from time to time in relation to which there may occur questions of professional conduct which do not come within any of these categories. In such instances, as in all others, the Council have to consider and decide upon the facts brought before them.

MALPRAXIS.

The question of malpraxis is very wide and cannot be discussed exhaustively here. It is advisable, however, to consider what is the law upon the subject and to illustrate the position by a few examples.

What amounts to Negligence. There is no definition of negligence applicable to every combination of circumstances. Negligence is not a statutory offence, though disregard of certain statutory provisions may be held to be negligence. Generally speaking, liability for both civil and criminal negligence is based on the Common Law of England.

Civil Negligence. To constitute civil negligence there must be:—

(i) A legal duty to exercise care.

(ii) A failure in the exercise of the care necessary in the circumstances of any particular case.

A breach of such duty by any person resulting in injury or damage to another is actionable in the Civil Courts. A medical practitioner impliedly indicates that he is possessed of the average degree of skill and knowledge possessed by similar practitioners. A specialist in any branch of medicine or surgery impliedly represents that he is possessed by similar specialists. Thus a medical practitioner has a duty to exercise that degree of skill and knowledge appropriate to his position in his profession and also to exercise a reasonable degree of care. A breach of such duty may render a medical practitioner liable to an action for negligence.

Criminal Negligence. Criminal negligence is negligence more grave than the breach of duty sufficient to support a civil action for damages. The negligence must be so great as to go beyond a mere matter of compensation between subject and subject, and show such disregard for the life and safety of others as to amount to a crime against the State and conduct deserving punishment. The distinction between criminal and civil negligence is well set out in the judgment in *R. v. Bateman* (1925) 19 C.A.R. p. 8.

A qualified assistant or locum tenens is personally responsible for any negligence which may be proved in his practice; he does not involve his principal. The matter is more complicated where unqualified assistants (students, nurses, etc.) are concerned. If the principal superintends the alleged negligent act of the assistant, he is liable; but if, in his absence, the subordinate omits to take some precaution in a matter which is within, or in acting goes beyond, the scope of his specific employment or directions, the principal will not be liable. A principal is not jointly liable for his assistant's criminal acts, unless he authorizes them or co-operates in their execution.

Who may sue for Damages for Negligence. If a man employs a physician or a surgeon to attend to his wife or child, and by reason of negligence on the part of the physician or surgeon, the patient suffers injury, the man can sue the physician or surgeon for damages for breach of contract. Apart altogether from the duty owed by the physician or surgeon to treat the patient with care and skill under the implied terms of the contract between him and the man who employed him, the physician or surgeon owes a duty to the patient to take care, by reason merely of the subsistence of the

relationship of medical practitioner and patient; and, in respect of any breach of this duty, the patient can sue *in tort* for damages for negligence.[1]

Negligence by Omission. If a medical practitioner, after having actually undertaken the treatment of a patient, wickedly neglects him, and the patient dies in consequence of such neglect, the practitioner will be guilty of manslaughter [see *R. v. Bateman* (*supra*)].

The most frequent cases are those where damages are claimed for permanent disability or disfigurement; and occasionally such a claim is made in order to justify a refusal to pay fees for medical treatment.

A physician who holds himself out as having special knowledge and skill in the treatment of particular diseases is bound to bring to the discharge of his duty not merely the average degree of skill possessed by general practitioners, but that special degree of skill and knowledge possessed by physicians who are specialists in the treatment of such disease in the light of the present state of scientific knowledge. The question when a physician becomes a specialist is not one of law, but one of fact primarily for his own determination; but, when he holds himself out as a specialist, it becomes his duty to use that degree of skill which such a practitioner should possess.[2]

In America the rule appears to be that a physician or surgeon when employed in his professional capacity is required to exercise that degree of knowledge, skill and care ordinarily evinced by physicians and surgeons practising in similar localities.

In a case where the plaintiff, under the direction of the defendant, assisted in dressing a wound on her husband and became infected with the poison by reason of slight scratches on her fingers, the defendant, who knew of the danger, was found guilty of negligence in assuring her that there was none, since he was not justified in assuming that her hands were free from such wounds. In another extraordinary case it was held that a physician is under no obligation while a person is his patient to tell her or her husband that a fragment of a needle, broken in a surgical operation, was left in her body, but it is his duty to tell her so when discharging her as his patient from his care.

These principles are still generally recognized in the English Courts.

In *Morris v. Winsbury-White* a surgeon was sued for damages for negligence in an operation for the removal of the prostate gland. After the operation the patient remained in hospital and was attended by the resident hospital staff. The treatment involved the insertion of tubes into the bladder and the frequent replacement thereof. An X-ray photograph revealed that a portion of a tube was in the patient's bladder. The Court held that the said portion had not been left there by the surgeon, and that the doctrine of *res ipsa loquitur* did not apply to the finding of a tube which had been left in the body after an operation.

Errors in Medical Diagnosis. Of the errors in diagnosis made by practitioners in ordinary medical work, the law knows very little, for it is very rarely that they result in litigation. Since the notification of infectious diseases has become compulsory, several cases of alleged negligence in regard to the diagnosis of these diseases have been brought into court either by aggrieved victims of the error or by the authorities responsible for recording notifications.

The remarks of the magistrate in the following case seem fairly accurately to represent the view which courts are likely to take of such cases:

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[1] *Gladwell v. Steggall*, 5 Bing. N. C., 733; *Pippin v. Sheppard*, 11 Price, 400.
[2] Levitt, W. M., 1953. In Modern Trends in Forensic Medicine. Ed. Keith Simpson. Butterworth, London.
[3] (1937) 4 All E. R. 494.

A medical man in practice at Battersea, appeared at the South-Western Police Court in answer to a summons for failing to notify a case of small-pox. There was no doubt as to the fact that a case of small-pox had been treated by the physician as chicken-pox, and that, in consequence of this mistake, other persons had become infected; but considerable doubt arose whether the defendant was aware of the nature of the disease to such an extent as to render him liable to conviction. It was suggested by the Battersea Borough Council, acting as the prosecutors, that as the *physician apparently felt some doubt in the matter, he should have* "taken advantage of the expert provided"—namely, the district medical officer of health—and that by failing to exercise all reasonable skill he was guilty of negligence. The magistrate who heard the case differed from this view, and refused to accept the contention that because he might have felt a doubt, the physician should have notified the case as one of small-pox. The magistrate pointed out that if a medical man, acting upon suspicion, caused the removal to a small-pox hospital of a man suffering from chicken-pox, the consequences would be very serious. He held that a medical man could not be expected to do more than to act to the best of his judgment; and, having acquitted the defendant of all negligence, he dismissed the case.[1]

The suggestion that the medical officer of health is provided as an expert whom medical men can consult in cases of doubt where dangerous infectious disease is suspected is clearly wrong. This is not the legal position of the medical officer of health: and, so long as his duties remain what they now are, any assistance he may afford in this way must be purely voluntary. To compel his attention, and to obtain his opinion by notifying a case which may turn out not to be one of the disease suspected, is a course which any medical man would properly hesitate to take. The question of how far a *medical officer of health should render assistance upon such occasions was* dealt with at some length in the *Lancet* of October 12th, 1901, p. 987, the occasion being the publication of some correspondence which had taken place between a medical man and a medical officer of health upon this subject. In the course of that correspondence, the latter wrote: "I am always pleased to assist my medical *confrères*, but you must understand that the diagnosis of cases is no part of the duty of a medical officer of health. The responsibility of diagnosis rests with the medical attendant entirely." This, we think, is a correct statement of the position. Whether some method should be devised to enable a medical practitioner to obtain the *opinion of one more experienced* than himself in the case of such a disease as small-pox is another matter. The power to do this would be a source of protection both to him and to the public.

Errors in Surgical Diagnosis. These are pre-eminently the cases which result in litigation and are those in which errors of diagnosis must almost inevitably result in, or be responsible for, errors in treatment. The most common type is that in which dislocations are described as fractures and fractures as dislocations: where it is alleged that the treatment has been incorrect and has resulted in the deformity of a limb or in the limitation of mobility of a joint. In many of the cases, even with the best, most skilful, and patient treatment, something in the way of detriment is almost inevitable, and, unless the practitioner is careful in regard to the management of the patient and his friends, more so perhaps even in regard to the treatment of the injury, trouble may arise.

The following is a typical case:

Thomas Webster, a collier, sued Dr. W. C. Rainsbury for damages for alleged unskilful treatment.

The plaintiff was a pitman employed at the Silverhill Colliery at Teversal. On November 26th he met with an accident whereby he sustained an injury to his left arm. He thereupon consulted the defendant, who was medical officer to the sick club of which the plaintiff was a member. According to the plaintiff's case the defendant, after examining the arm, said that no bones were broken, and merely prescribed bathing and painting with iodine to reduce the swelling. In the following January the plaintiff consulted a lamp cleaner at a neighbouring colliery who had a reputation as a bonesetter. He also consulted another bonesetter. According to the plaintiff's case neither of these bonesetters would undertake his case as each said that the elbow was dislocated, and that, as the injury was of old standing, he could not do anything with it. In the end, about a year after the accident, the plaintiff went to Charing Cross Hospital, where Mr. Charles Gibbs performed an operation. The negligence alleged was in allowing the plaintiff to go about for six weeks with a broken arm.

The defendant said that when the plaintiff came to him he complained of a swelling in the left arm. He had been unable to complete the diagnosis at the time owing to this. The plaintiff never told him that he had been to the bonesetters, and never complained of improper treatment.

In the opinion of the judge a country doctor was not expected to have so much skill as the surgeon of a London hospital. He was expected to have reasonable skill, and to exercise reasonable care in the treatment of his patients. The important question for them to determine was whether the defendant had reduced the dislocation. There was a difference of opinion as to the swelling, but the doctors all agreed that the swelling made a diagnosis difficult. The plaintiff said that the defendant told him there was no dislocation, but the defendant denied this. The evidence was that the plaintiff came up daily to see the doctor. The arm was out early in January; the lapse of such a long time as that resetting had become impossible. In serious cases it was the duty of a country doctor to send his patients to a hospital. Here the defendant said he had sent him, but the question was whether he had sent him early enough.

The jury awarded the plaintiff £25 damages.

A case of somewhat similar nature occurred some years ago:

In a bicycle accident a man sustained, among other injuries, damage to his shoulder. The medical man asserted that he examined the shoulder carefully and failed to detect any dislocation until some time after the accident. The witnesses for the patient stated that the examination was careless, having been made with the coat still on. Two eminent surgeons gave evidence that, if the dislocation had been present at first, it would have been detected by the medical man, and also that it might have occurred some time subsequently to the accident. The patient lost his case.

So far as the courts are concerned the results are determined by the general principles already enunciated, i.e., by evidence as to care and average skill.

In every case where there is difficulty in diagnosis, and in every case where the patient has sustained some violence which might possibly have caused fracture or dislocation, the practitioner who does not have an X-ray examination made exposes himself to unnecessary risk. Moreover if there is any doubt about the diagnosis in such a case the practitioner should have a consultation with a surgical colleague, or if that is not desired send the case to hospital.

For further remarks on the X-rays applied to such conditions,

Refusal to Continue in Attendance. A dissatisfied patient will sometimes allege that refusal to continue in attendance constitutes negligence. The question must arise occasionally whether the practitioner is under a duty to continue with a case after he has seen the patient once. Continued attendance may, in some cases, prove very irksome, especially if the patient lives

at a distance and is not a regular patient. The following Scottish case seems to indicate that, although a medical man is not bound to continue attendance, damages may sometimes be awarded against him.

The practitioner, as the nearest medical man, had been called in to attend a labourer who had sustained a fracture of the right tibia just above the ankle. Upon examination, the practitioner found that the man was not in a fit state to have the leg set, and for several reasons he advised that he would be better at the Edinburgh Infirmary, six miles off. Having done up the patient's leg so as to guard it against the dangers of travelling, he sent him to hospital, intimating at the same time that he would have nothing more to do with the case. He was not the regular attendant of the patient, nor was he the surgeon for the mill at which the patient had been working. Further, the practitioner never entered the patient's name in his books, nor did he ask any fee for what he had done. After seeing the patient the practitioner was himself laid up with influenza for a month, when he again saw the patient, who had never been moved to the hospital. By that time the mischief had been done, and as the result of an operation which was then found necessary one leg was shorter than the other.[1]

Lord Adam, who charged the jury in an action brought for negligence against the practitioner, said that the case turned altogether on the question whether the practitioner had undertaken to give his continuous professional attendance to the patient. He remarked also: "Because a doctor attends a man in an emergency, it does not follow that he is bound to go on with the case. Unless it is proved that, besides doing what he did, he also undertook to treat the pursuer as his patient, the obligation ceased". In spite of this very explicit direction, the jury awarded the patient £50 damages. Although the jury decided in favour of the patient, the direction of the learned judge in the above case represents an accurate statement of the law, and it corresponds with the attitude taken up by American courts.

In *Keller* v. *Lewis*[2] a physician gave his services gratuitously to a patient who knew that he was going away. It was held that he was responsible only for such treatment as he had administered personally, and that he could not be held liable for any negligence or want of skill on the part of a physician who was called in subsequently.

Errors of Commission.   The general rule applicable in such cases is "the practitioner must take sufficient care over the case and give it proper attention". This rule applies in cases where diagnosis has been incomplete or inaccurate, and wrong treatment in consequence has been applied, for instance:—

In Australia a surgeon was sued for negligent and unskilful treatment of a fractured elbow-joint. The alleged want of skill consisted in the arm having been kept in rigid splints for twelve days before passive motion was commenced. The surgeon stated that he kept the splints on because the joint was too inflamed to be moved, and that the boy could not move his arm through an angle of 45 degrees. Several medical men gave evidence for the surgeon, and stated that there was no evidence of any malpractice or negligence. Nevertheless the jury awarded the plaintiff £200 damages.

Charges of manslaughter have been brought against medical practitioners in cases of midwifery. In some instances gross mismanagement has been proved; the uterus and even parts of the viscera have been torn away, and in such cases convictions have followed.[3] It is well known, however, that

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[1] *Brit. med. J.*, 1894, 1, 755.
[2] 65 Ark, 578.
[3] See *R.* v. *Bateman*, *supra*. In this case the greater portion of the uterus was removed in extracting the placenta, and the bladder ruptured as well as the rectum. The physician was convicted of manslaughter in the Central Criminal Court, but this conviction was quashed on appeal.

much difference of opinion exists among the most eminent practitioners of midwifery respecting the treatment to be pursued in difficult cases.

Negligence in Operations. It is only on rare occasions that a recognized surgeon is charged with negligence in the performance of an operation. General practitioners should, of course, be careful not to undertake operations which are beyond their skill.

Allegations of negligence are made most frequently in cases where the surgeon has either exceeded the limit of a permitted operation or has left instruments or other foreign bodies in a wound.

Exceeding the Limits of a permitted Operation. If during an operation an unforeseen extension is seen to be inevitable, e.g., the compulsory amputation of the leg when by mishap the popliteal artery is damaged during an arthrectomy, proof that such was in the opinion of the surgeon honestly necessary for the life or health of the patient would be sufficient to exonerate him.

In an unreported case the plaintiff, who was a nurse, alleged that she had expressly forbidden the removal of both ovaries, although she had consented to the removal of one. The surgeon's contentions were:—

1. The operation had been left to his discretion, based upon the result of his exploration.

2. The double ovariotomy was necessary at least in order to prolong the nurse's life, if not to enable her to escape imminent danger.

3. The operation was not the cause of her sterility, as she was necessarily already sterile from her cysts.

The jury decided in favour of the surgeon, and added that, in their opinion, "an action ought never to have been brought". This decision was upheld by the Court of Appeal.

Several practical points are presented by this case:

1. It is advisable to have a definite understanding, in writing if possible, as to the scope and possible results of one's operative treatment, and it is preferable to have it stated clearly that the matter is left to one's discretion to act when one has gained full information. This is particularly important where a series of operations or examinations under an anæsthetic is required.

2. If one's patient is "under", and one sees that one must exceed the limits of one's permission, one should consult with the nearest relative at hand, or else be able to rely on the extreme necessity of the case before proceeding.

3. It should always be remembered that one is operating upon a possible plaintiff.

Foreign Bodies left in the Wound or Abdominal Cavity. Since the South African case of *Van Wyk* v. *Lewis* (1924),[1] the English Court of Appeal in 1939, in *Mahon* v. *Osborne*,[2] has considered the duty of a surgeon in cases where a foreign body has been left in the wound after an operation. The patient's mother brought an action for damages against the surgeon who performed an operation for the removal of a duodenal ulcer. A swab which had been used by the surgeon to pack off adjacent organs was left in the patient's body, with the result that he died three months later. It was held that there was no general rule of law which required a surgeon at the end of

[1] *Brit. med. J.*, 1033, 1, 1027.
[2] (1939) 2 K. B. 14.

an operation of this kind, after removing all the swabs of which he was aware, to make sure that no swabs had been left in the patient's body, and that the question whether or not the omission by the surgeon to remove a swab constitutes a failure by him to exercise reasonable skill and care must be decided on the evidence given in the particular case.

In an earlier case (*Crotch* v. *Miles*)[1] Miss M. H. G. Crotch brought an action for damages against Mr. W. E. Miles for injury alleged to have been caused by the surgeon's having left a pair of forceps in her abdomen after an operation in November, 1920, for the removal of a fibroid tumour. The case was heard by the Lord Chief Justice of England and a special jury. After a long summing-up the Lord Chief Justice left three questions for the decision of the jury, viz.:—

1. Is it established that the forceps were left in the plaintiff's body in the course of the operation performed by the defendant?

2. If so, was that fact due to negligence on the part of the defendant, or for which he was responsible?

3. The question of damages, if it arises.

The jury were absent only ten minutes, and they answered in the negative the first question left to them. Judgment was entered for the surgeon, with costs.

The courts seem unwilling to hold the surgeon responsible unless there is proof that he was personally negligent. [See *Morris* v. *Winsbury-White* (*supra*).]

X-rays in Diagnosis and Treatment.

This method of investigation and treatment of certain affections has become so important that every practitioner should have a clear idea of the value of X-ray examination and treatment in various conditions, and make sure that his patients are advised to make use of them in suitable cases. Neglect of this has led to actions for malpraxis on many occasions.

This is not the place in which to discuss the clinical value of X-rays, but their value in the diagnosis of bone injuries and displacements, in disease of bones, in head injuries. etc., is common knowledge, as is their importance in diagnosing and defining the position of foreign bodies in the tissues. They are also invaluable in the diagnosis of disease in many of the viscera by the injection of substances opaque to the rays and in the treatment of certain diseases of the blood, glands and skin. Deep X-ray therapy for the treatment of malignant disease is also in common use.

The rays are capable of causing profound changes in the blood and tissues, of producing severe dermatitis or burns of a most intractable nature, and even of a malignant condition of the skin. They must, therefore, be used with due care and by persons skilled in their application.

Negligence in Treatment by Artificial Light.

Ultra-violet light differs considerably from sunlight in its wavelength. Ordinary visible light has a wavelength varying from 7,000 Angström units at the red end of the spectrum to 4,000 A.U. at the violet end, whereas ultra-violet light comprises wavelengths from 4,000 to 2,000 A.U.

In sunlight the spectrum ends at about 3,000 A.U., and therefore its ultra-violet radiation is comprised entirely of rays between 4,000 and 3,000 A.U., and the body has become accustomed to these rays.

In the mercury vapour lamp and similar sources of artificial sunlight there

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[1] *Brit. med. J.*, 1930, 1, 620.

is a considerable proportion of light of shorter wavelengths, e.g., 3,000–2,000 A.U.

The body is unaccustomed to light of this nature, and therefore, unless the radiation is properly controlled, there is great danger of injury to the patient.

The use of this light however for the treatment of various local and systemic diseases has reached a stage where the control of such treatment is passing from the hands of specialists into the hands of the untrained and unqualified. It is to be expected, therefore, that burns and other injuries will become more common. An old man who was in the habit of giving himself an "artificial sunbath" went to sleep under the rays for an hour and ten minutes. As a result there were severe burns and general disturbances, from which the man nearly died.

In *Anderson or Lavelle v. Glasgow Royal Infirmary (supra)*, a woman under treatment by ultra-violet light was placed in the light room and ordered to walk about until she was told to come out. She remained there for 45 minutes, and as nobody came to her she walked out herself. As a result of the prolonged exposure (the usual time for a first exposure was ten minutes) she was badly burned, and brought an action for damages against the institution. The case came before the Court of Session and the House of Lords: and judgment was given in favour of the hospital.

Negligence in Promoting Drug Habits.

The case of *Forsythe v. Law*[1] should be regarded by all medical men who have dealings with patients addicted to drug-taking as a warning against doing anything which could possibly be made the basis of an accusation that they were lending their aid to a continuance of the habit. (See also "Dangerous Drugs" in Vol. II.)

Negligence in Cases of Criminal Wounding.

Inasmuch as on the death of the victim within a year and a day after the wounding[2] the assailant must be charged with murder or manslaughter, the question of medical negligence may assume great importance, for it may be alleged that death would not have occurred if the case had not been treated improperly by a medical man.

In these circumstances the question may arise as to how far the treatment aggravated the effects of the violence; and the court may have to decide, from the evidence of a medical witness, as to the degree of criminality which attaches to a prisoner. If, for instance, an ignorant person removes a clot of blood, which sealed up the extremity of a blood-vessel, and as a result fatal bleeding ensues, or death is caused by unnecessarily interfering with a penetrating wound of the chest or abdomen; it would not be just to hold the aggressor responsible for homicide.

A serious responsibility rests upon practitioners who undertake the treatment of cases of criminal wounding. Any deviation from common practice, therefore, should be made only with the greatest caution. Upon these occasions every matter connected with the surgical treatment will be the subject of rigorous inquiry and professional criticism. In the case of a severe lacerated wound in the hand or foot, it may be alleged that the wounded person would not have died if amputation had been performed at once. A practitioner may be able to justify himself by showing either that the injury was too slight to

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[1] *Lancet*, 1902, I, 680.
[2] This refers to the Law of England; under Scots Law the lapse of time between the infliction of an injury and the death of the victim does not alter the responsibility of the assailant if it can be shown that the death was undoubtedly due to the injury.

require amputation, or that the health of or other circumstances connected with the deceased would not allow of its being performed with any reasonable hope of success. On the other hand, if the practitioner performed amputation, and the patient died, then it might be urged that the operation was unjustifiable and that it had caused death. Here the surgeon is bound to show that the operation was necessary, according to the ordinary rules of practice. The treatment of severe incised wounds of the throat, when the windpipe is involved, sometimes places a practitioner in an embarrassing position. If the wound is left open, death may take place from bleeding; if it is prematurely closed, blood may be effused into the windpipe and cause death by suffocation.

Lord Hale drew a very nice distinction between death resulting from a wound rendered mortal by improper treatment and death resulting from improper treatment, irrespective of the wound. In most cases such a distinction could scarcely be established, except upon speculative grounds, and in no case, probably, would there be any unanimity in the opinions of medical witnesses. In slight and unimportant wounds, it might not be difficult to distinguish between the effects resulting from improper treatment and those connected with the wound, but there can be few cases of severe injury to the person wherein a distinction of this nature could safely be made. The probability is, that no jury would convict of murder if the medical evidence showed that the wounding was not originally mortal, but became so only through unskilful or improper medical treatment. In such a case it would be impossible to ascribe death to the wounding, or to its usual or probable consequences.

If death had been caused by the wounding, it is immaterial that in more favourable circumstances, and with *more skilful treatment*, a mortal result might have been averted.

The true distinction in all such cases is, that if the death is occasioned by grossly erroneous medical treatment, the assailant will not be guilty of felonious homicide; but if death is the result of lack merely of that higher degree of skill which is normally available only in great towns, the assailant will be responsible, because he wilfully exposed the deceased to a risk from which he has practically no means of escaping.

If the wounding had not been likely to produce death, but, through unskilful treatment, death ensued, that would not be felonious homicide.

During a quarrel a man received a bite on the thumb. He went to a quack' who applied some irritating ointment, which led to severe inflammation, and this rendered amputation of the arm necessary. He died from the effects of the operation. Medical evidence was given that the injury caused by the bite was slight, and would probably have healed but for improper treatment. On this evidence the biter was acquitted.

Where, owing to improper treatment of the injured part, an operation became necessary, and resulted fatally, the assailant would probably not be guilty of murder. Much discussion has arisen on this question, and many theoretical cases have been enunciated, e.g. What if the fatal condition was not *propter*, but merely noticed *post*, the alleged injury (e.g., an aneurysm first noticed after a blow may be mistaken for an abscess and may be opened with fatal result)?

Thanks to the increase in skill on the part of medical practitioners and the increase in the number of hospitals in Great Britain, cases of improper treatment are becoming very rare; but they are allowed to remain in this work because they are still important in places where such facilities may be lacking.

For an interesting case of death under an anæsthetic after criminal wounding, *vide* p. 74. In the paragraph referring to violent deaths there are also some further observations on the subject.

Gratuitous Treatment. When a medical practitioner undertakes orally to treat a patient gratuitously, an action for damages *in tort* will lie if the treatment be given negligently: for although no action will lie for not giving the treatment (there being no consideration for the promise), the law imposes a duty to take care to use such skill as one possesses or even professes to possess.

Recovery of Fees. It was decided long ago[1] that if the patient receives no benefit, *in consequence of the practitioner's want of skill*, the latter cannot recover his fees; but the remuneration of a practitioner who has used due skill and diligence does not depend upon his effecting a cure. In the case of a surgeon, if an operation which might have been useful has been unsuccessful, he is nevertheless entitled to charge; but if it could not have been useful in any event, he has no claim.[2]

Who Is the Person Responsible. By the fact of his registration under the Medical Acts a presumption arises that a qualified medical man knows his work and does it properly, and he has no need to adduce evidence of general skill and fitness; he is held *prima facie* to be competent in any lawful act, and the onus of proof to the contrary lies on the one who alleges it; if he poses as a specialist, a greater competence will be presumed; and yet considerable latitude in the practice of any theory or line of treatment will be allowed. This latter statement is based upon the Medical Acts of 1858 and of 1886, under which the General Medical Council is entrusted with the responsibility of setting up a standard of proficiency in general professional knowledge; but it cannot refuse recognition to a duly qualified practitioner because he upholds, or professes, or refuses to uphold and practise certain lines of treatment.

Hospitals. The legal position of the governing body of a public hospital was considered by the Court of Appeal in *Gold* v. *Essex County Council*[3] where the earlier decision of the Court of Appeal in *Hillyer* v. *St. Bartholomew's Hospital*[4] was reviewed. It has now been held that the obligations undertaken by those in control of a hospital in regard to a patient therein are not confined to the provision of skilful nurses, or skilful persons, such as radiographers, for giving the patient prescribed treatment. The obligation which they undertake is that of nursing or treating the patient, as the case may be. Accordingly, they will be liable for the negligent act of a nurse committed, whether in the course of actually nursing the patient, or while performing some purely administrative duty such as serving his meals, which is merely incidental to the primary task of nursing, or for the negligent act of a skilled person, such as a radiographer, committed in the course of administering treatment properly prescribed by a medical practitioner.

It is now established that the Hospital Authority is liable for the negligence of surgeons and doctors employed in it. (*Cassidy* v. *Ministry of Health* (1951) L.R. II K.B.

[1] *Kannen* v. *McMullen*, Peake, 59.
[2] Alderson, J., in *Hill* v. *Featherstonhaugh*, 7 Bing. 574.
[3] 58 T.L.R. (1942), 557.
[4] [1909] 2 K. B., 820.

In the opinion of Lord Greene, M.R., the true ground on which a hospital escapes liability for the act of a nurse who, whether in the operating theatre or elsewhere, is acting under the instructions of a surgeon or physician is not that *pro hac vice* she ceases to be the servant of the hospital, but that she is not guilty of negligence if she carries out the orders of the surgeon or physician, however negligent those orders may be. There is no reason, on principle, why, if she carries out an order negligently, the hospital authorities should not be liable.

Some important observations were made by Lord Greene and by Goddard, L. J., in the *Gold* case as to the position of local authorities who provide hospital accommodation in accordance with Part VI of the Public Health Act, 1936.

The House of Lords held in *Strangways-Lesmere v. Clayton*[1] that where two nurses, acting on a surgeon's orders, negligently administered to a patient six *ounces* in mistake for six *drachms* of paraldehyde, in consequence whereof the patient died, the nurses alone were responsible and not the hospital authorities.

There is a distinction between "matters of professional skill" and "purely ministerial or administrative duties". The governors of a hospital are not responsible for the discharge of skilled duties; but they are responsible for the discharge of administrative duties. The distinction between these two classes of nursing duties was considered by the House of Lords in *Anderson or Lavelle v. Glasgow Royal Infirmary*.[2]

In *Weigall v. Westminster Hospital*[3] the mother of a patient was awarded £2,826 damages for personal injuries suffered as the result of her slipping on a mat which had been placed on a floor in the hospital covered with highly polished linoleum. The Court of Appeal held that the Hospital authorities had not taken reasonable care to prevent damage from unusual danger.

Nursing Homes and Nurses. If the proprietors of a nursing home, sanatorium, or other similar institution undertake to nurse or to treat patients, the nurse or medical practitioner who carries out the nursing or treatment is the agent of the proprietors; and the latter are responsible for every act of negligence which the nurse or medical practitioner may commit.

In *Lindsey v. Marshall*[4] the House of Lords held that a patient in a maternity home was entitled to recover damages for negligence on the part of the governing body of the home on the ground that the staff of the home after an outbreak of puerperal fever had admitted patients before having ascertained whether any of the staff were carrying infection of puerperal fever.

In *Powell v. Streatham Manor Nursing Home*[5] the House of Lords in 1935 restored a judgment for £3,477 damages awarded against a nursing home in respect of negligence in the treatment received by a married woman in connection with an operation for hysterectomy performed while she was a patient in the home.

Physicians and surgeons are not responsible for the negligent acts of nurses whom they have good reason for believing to be competent, unless they are present at the performance of the act complained of, and are able to exercise control. It is always a question of fact whether a particular duty properly falls within the scope of a nurse, having regard to the practice in the institution concerned and in the profession generally.

[1] [1936] W.N. 244.
[2] Brit. med. J., 1933, I, 767.
[3] (1936) 52 T.L.R., 301.
[4] [1937] A.C., 97.
[5] The Times, March 1st, 1935.

Contributory Negligence by Patient. Of the cases of contravicarious responsibility, i.e., cases in which the practitioner seeks to throw the onus upon the patient, because the latter did not follow instructions, and thus caused the injury or delayed recovery, it would seem that natural justice would not suffer a practitioner to be held responsible for a patient's disobedience of instructions given solely for his own benefit.

The actual errors of practitioners fall naturally under one of two headings, viz., omission, or commission: but it is obvious that in some cases very definite lines of treatment, often in opposite directions, have to be pursued on the basis of diagnosis; the two cannot therefore be altogether separated in practice.

Dental Cases. Dentists are not infrequently proceeded against directly (or by a counter-claim set up against a bill) for negligence in breaking off a portion of the jaw in tooth extraction, but such cases as the following are very unusual:—

A claim for damages was brought against a consulting dental surgeon at the Cardiff Infirmary for alleged unskilful extraction of a tooth. The tooth in question was an upper canine; and it was alleged that "unnecessary force was used, with the result that the tooth was forced upwards into the cavity of the cheek, and became embedded in the cheek-bone and the cartilage of the nose, just below the lachrymal duct". It appeared that the tooth was not extracted; but that the forceps slipping over the conical part of the tooth, forced it up under the skin near the corner of the eye. Swelling and pain followed; and the patient was seen by several medical men who at first failed to diagnose the unique condition, and were, moreover, misled by the statement of the patient that the tooth had been extracted. The use of the Röntgen rays, however, clearly demonstrated the condition, and the tooth was removed by a simple skin incision. The evidence of the four medical men who examined the patient was against there having been any negligence in the attempted extraction, although it appears that the dentist in question had not ascertained whether the tooth was out or not.

The judge held that if there was no negligence in the operation proper, it was immaterial that there was failure to find the tooth. The claim failed.

In another case a woman went to a dentist to have a tooth extracted by the dentist's "painless process". The operation was not successful, for broken pieces of the tooth were left in the patient's jaw. It was held that a cause of action *in tort* lay against the dentist in respect of the breach of his duty to use proper skill in the practice of his profession, irrespective of the contract to perform the operation by a "painless process".[1]

If a dentist acts in conjunction with a medical practitioner, it is no part of the dentist's duty to discover the general health of the patient. It is not negligent for a medical man to allow the extraction of many teeth to be made without making a preliminary blood test. (*Warren v. Greig*[2]; and *Warren v. White*[2].)

NEGLIGENCE IN ANÆSTHESIA

The giving of any kind of anæsthetic is a task calling for special knowledge and experience, for obviously no anæsthetic can be free from danger. A registered practitioner, therefore, who administers an anæsthetic assumes a responsibility that may, in the event of disaster, be assessed with as much care as that of the surgeon. He must exercise due caution at each step taken during anæsthesia *and until full recovery from its effects*. The latter duty is often overlooked with disastrous results.

[1] *Edwards v. Mallan* (1908) 1 K.B. 1002.
[2] *Lancet*, 1935, 1, 330.

A child of five years, healthy except for recurring tonsillitis, was operated upon under nembutal gr. 1½ (10.30 a.m.), ethyl chloride and ether (12.05–12.20 p.m.), both tonsils being dissected away. The throat had been packed and anæsthesia administered by intra-tracheal tube. Bleeding appeared to have been controlled when the child was returned to the ward at 12.30 p.m. It was comfortable until about 3.20 p.m. when a rise in respiration and pulse rate was noted. It was pale, ashen grey and anoxic when the H.S. was called at 3.30 p.m., and died in spite of restorative measures at 3.40 p.m.

Autopsy revealed a trickle of blood into the glottis and widespread obstruction of the bronchial tree by inhaled blood. It had not been anticipated, and no active measures (apart from being placed prone) had been taken to avert it.

Within a period of three months in September 1949, two fit subjects of 37 and 53 who had had excision of knee cartilages—left the operating theatre fit, but in charge only of (a) a hospital porter or (b) a pupil nurse who had to negotiate a lift and a considerable length of corridor before arrival at the ward. Each was seen to be cyanosed on being lifted from the trolley to the bed, and each was found, in fact to be dead.

The coroner, to whom all deaths "before full recovery from anæsthesia"—or, often, all deaths within 24 hours of administration of an anæsthetic—are reported, may order an autopsy by an independent pathologist, but is unlikely to hold an inquest unless there has been some avoidable mishap or serious misjudgment. The risks taken by the thoracic, cardiovascular and neurological surgeon are so great in modern times that it would be quite unfair to ask that all deaths not strictly due to natural causes should be discussed at inquests (before a public that cannot possibly appreciate the technical details and difficulties of the procedures undertaken).

When the cause of death may reasonably be regarded as one of the accepted risks of the procedure undertaken—as in fat embolism during the fracture and manipulation of bones for orthopaedic purposes, pulmonary œdema following release of the shunt in Blalock's operation for pulmonary stenosis or reflex cardiac arrest during mitral valvulotomy—then the coroner is empowered to dispense with an inquest. When an anæsthetist endeavours to prevent vomit from fouling the airways in a case of intestinal obstruction but fails, it is not to be suggested that death ensued from any lack of due care and skill. This[1] is the operative phrase; it lacks statutory backing but has for some years, gained by usage sufficient obvious merit to justify its continuance.

In Scotland the Procurator Fiscal may be satisfied with a report given to him by the police surgeon or other medical officer appointed by him after such officer has consulted the surgeon, anæsthetist, nursing staff, etc. If he is unable to decide the matter from such consultation, post-mortem examination will be ordered by the Sheriff. In England an autopsy is routine procedure in all such deaths.

The anæsthetist should be particularly careful about the following points:—

1. Obtaining written consent to the procedure.
2. Making a clinical examination of the patient to decide for himself the suitability of the subject for the procedure.
3. Checking the drugs to be given, bottles of fluid and the apparatus to be used himself.
4. Taking precautions to prevent fire and explosion especially when electro-cautery is being used.
5. Never relaxing vigilance for a moment until the patient is fully enough recovered from the effects of anæsthesia to be left safely to the care of the nursing staff.

[1] Purchase, B., 1946. Jervis on Coroners. 8th Ed., p. 58. London: Sweet & Maxwell.

Some examples of the disasters that may attend failure to exercise care over these points may be listed:—

In 1951 a packer was awarded £400 damages for negligence against the North West Metropolitan Regional Hospital Board. He had been operated upon for a duodenal ulcer and, during the operation, had had his left arm strapped above the head for injection of a relaxant. A brachial plexus lesion ensued, and litigation followed upon the allegation that this was due to careless fixation of the arm.

In October 1951, a woman aged 55, who had been admitted for radical mastoidectomy was found fit for operation and induced by thiopentone and flaxedil. The anæsthetist was giving oxygen through an insulated rubber breathing bag and facepiece, controlling the valve of the oxygen cylinder on the anæsthetic trolley with one hand, when there was an explosion. It appeared to be in the facepiece: he was thrown to the floor and there was a fire on the trolley. The patient's eyelashes were singed, and eyelids bruised and the nose peeling, but respiration was maintained by intratracheal tube (some bruising of the palate and pharynx being noticed) and as the pulse was good the surgeon completed the operation. One hour and ten minutes later the patient collapsed and very shortly afterwards died. Extensive splitting of the œsophagus and cardia was found at autopsy. The explosion was ascribed to static electricity.

A 58 year-old man was operated upon for perforated peptic ulcer. During the induction of anæsthesia an oxygen cylinder became empty and a supply was turned on from a spare cylinder fitted by a theatre attendant at the end of the previous case. After a few minutes the patient's colour was noticed to be so bad that everything except what was thought to be oxygen was shut off. The patient's colour worsened and he died, deeply cyanosed, a few minutes later. The cylinder was found to contain nitrous oxide and the anæsthetist excused himself by saying "I took it for granted that when I asked for oxygen I would get it."

At an inquest at Westminster in 1952 it was admitted that a four-year old child had been given 0·5 gm. of pentothal in 10 cc. of water mixed with 20 cc. of surgical spirit (in error for saline) per rectum in preparation for a tonsillectomy. The blood alcohol was 260 mg. per cent when measured 20 hours later (3 per cent of this methyl alcohol) and death took place on the following day, some 23 hours after this grave error had occurred.

Mr. Justice Hallet observed at the Notts. Assizes in 1951, in apportioning responsibility to the Jury in a case in which an error of judgment in giving an anæsthetic had been alleged: "Professional men, and especially doctors, ought to observe a proper standard of professional care." He added "it would be undesirable, and indeed disastrous, if doctors faced with the necessity of making decisions and taking responsibilities were to have their courage sapped by feeling that, if they made a mistake, they ran the risk of being found guilty of negligence".

In each of the cases quoted above, however, there was an element of carelessness and a failure to exercise that care and alertness which a patient has a right to expect of an anæsthetist, and which justified the civil litigation which ensued. Even when unsuccessful, such civil actions occasion much worry and expense which is avoidable if reasonable care is exercised.

Even when reasonable care is exercised, excessive reactions to anæsthesia may occur, for example when intravenous barbiturates are administered rapidly and without the experienced caution that might follow from long practice.

Board was responsible for the provision of some reasonably competent person to assist her in the event of difficulty. Appeal resulted in the anæsthetist having to bear 20 per cent of the liability.

ANÆSTHESIA AND CRIMINAL CHARGES

Where anæsthetic/operative procedures are concerned with cases of wounding and death ensues through some mishap the charge may be stepped up—say from felonious wounding to manslaughter—whatever the merits or faults of the procedures undertaken.

In *R.* v. *Hughes* a man was brought into the London Hospital late one evening bleeding from a punctured wound in the left forearm. The loss of blood was judged by the house surgeon to be so serious as to necessitate careful examination of the wound under an anæsthetic. *During the return to consciousness the patient vomited* and choked himself with the contents of his stomach.

At the inquest a verdict of manslaughter against the assailant was returned, and at the subsequent trial the judge said:

"This case is remarkable in that it goes a step further than any previous case where a wounded man has died from the effects of a necessary operation.

"Here it was not the operation, but the anæsthetic, which accelerated the man's death. Now, had not the man misinformed the anæsthetist as to the time of his last meal, which there is no doubt he did, the anæsthetic would have borne no danger to life.

"Therefore it was the dead man's own mistake that caused his death, and the prisoner could not be held responsible for such a mis-statement."

Hughes was found guilty of feloniously wounding with intent to do grievous harm.

A somewhat similar case occurred at the Liverpool Assizes when a man and a woman were charged with the manslaughter of a man with whom the male prisoner was fighting. The blow which caused the death was delivered by the female prisoner. Death was caused in rather a strange way. The female prisoner struck the deceased man on the eye with the neck of a broken bottle. The eyesight was destroyed, and the eyebrow was cut. In the circumstances it was deemed necessary to perform an operation upon the man, and for that purpose an anæsthetic was administered. From his appearance and condition the man seemed to have been a proper subject for an anæsthetic. During the course of the operation, however, he appeared to be in a fainting condition, and he ultimately died from the administration of the anæsthetic in a way which the doctors were unable to account for. The judge said that in a case of this kind it might be contended with much plausibility that *the person who struck the blow in the first instance, and thereby rendered* the operation necessary, was liable for the consequences. But it was not desirable in a case of this kind to let the case rest upon such a principle, and therefore if the grand jury found a *prima facie* case against the woman he (his lordship) would have a bill drawn charging her with *wounding the man with intent to do grievous bodily harm*, leaving his death an open question. The grand jury adopted his lordship's suggestion, and the prisoners were tried for unlawful wounding.

The practice is for the Crown to proceed with the graver charge, but for the Judge to indicate to the Jury that a series of unfortunate consequences of accused's act can hardly have been foreseen and hardly, therefore, reasonably ascribed to the unlawful act of wounding for the purpose of assessing "guilt" and punishment. It is yet another instance of the difference between strict law and practice in which the sense of fairness prevails.

NEGLECT BY PARENTS AND OTHERS

If a grown-up person is under a duty to take care of another, such as a parent of a child, or chooses to undertake the charge of a human being helpless either from infancy, simplicity, lunacy or other infirmity, such person is bound to discharge the duty or execute the charge without reckless

negligence. If a person who is in charge of a helpless creature lets it die by reckless negligence that person is guilty of manslaughter. Mere negligence will not do. There must be negligence so great as to satisfy a jury that the accused was recklessly careless as to whether the person in charge died or not. There are a number of cases on this subject, of which the following may usefully be consulted: —

> R. v. *Morby* (1881) 8 Q.B.D. p. 571 (Neglect to provide medical help).
>
> R. v. *Charlotte Smith* (1865) L. & C. p. 607 (Neglect to provide food and lodging).
>
> R. v. *Chattaway* (1922) 17 C.A.R.
>
> R. v. *Bonniman* 28 C.A.R.
>
> R. v. *Senior L. R.* (1899) 1 Q. B. p. 283.

The Appeal Court in *Oakley* v. *Jackson* (1914, 1 K.B., 216) made it clear that the real test was the reasonableness of the decision in the particular circumstance, not the medical necessity of any procedure which is refused. The parent or guardian must seek or make available the medical attention which is necessary—but there is no obligation to consent to operation. The case was one in which a father refused to agree to the removal of adenoids in a daughter aged 13 years.

The Children and Young Persons Act, 1933, facilitates prosecution for neglect in cases where a parent or other person having charge of children fails to provide medical aid.[1]

In 1941 a labourer was charged at Glamorgan with failing to provide adequate medical attention for his son aged 6. The boy had suffered for some months from tuberculosis of the knee and had been in a hospital for treatment for 14 months with considerable improvement. He was re-admitted some months after return home very much worse, and amputation was advised. The father refused and prosecution followed.

At trial a jury accepted the father's plea that his refusal was reasonable in all the circumstances. It was pleaded on his behalf that he had not been told that his son's life was in danger and had only provisionally refused consent in the belief that the operation was likely to be fatal.

In 1935 a man and his wife were convicted under the Children and Young Persons Act, 1933, of failing to provide adequate medical aid to a child in their custody, who on medical evidence had died because of its parents' neglect to provide medical aid. The parents were members of the "Peculiar People" sect.

In November, 1953, the father of a girl aged six days said at a Leeds inquest that he was a Jehovah's Witness and could not allow her to have a blood transfusion because it was "against God's holy law". The child died after an operation for reconstitution of a congenital œsophageal atresia—during which the surgeon had wished to give blood. An official of the Sect referred to Acts chapter 15 verses 28 and 29 wherein the words "That ye abstain from meats offered to idols and from blood and from things strangled. . . ."

Herbalists, bonesetters, chiropractors, osteopaths and other unregistered practitioners may practice their particular cult without hindrance, within the limits mentioned in this chapter, provided they do not pretend to be registered medical practitioners.

The position of herbalists, so far as regards criminal responsibility, was stated by the Court of Criminal Appeal in *R. v. Burder*.[2] In that case the accused (a violinist) was interested in herbalism and fasting as a cure for rheumatism; and in April, 1916, he commenced giving advice, for which he charged fees. In July, 1916, he gave advice to a confirmed invalid, and the

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[1] *Brit. med. J.,* 1941, 2, 832.
[2] (1917), 86 L. J. K. B. 871.

patient died soon after she had abstained from food, in accordance with the accused's advice. There was medical evidence that death was caused by heart failure, due to disease of the heart, but accelerated by lack of food. The accused was convicted of manslaughter.

In giving the judgment of the court, Darling, J., said: "If any person, whether he be a regular or licensed medical man or not, professes to deal with the life or health of His Majesty's subjects, he is bound to have competent skill to perform the task that he holds himself out to perform, and he is bound to treat his patients with care, attention and assiduity".

Advertisements by herbalists and other unregistered persons relating to (a) articles to be used for the treatment of Bright's disease, cataract, diabetes, epilepsy or fits, glaucoma, locomotor ataxy, paralysis, or tuberculosis, and (b) articles to be used for procuring the miscarriage of women are prohibited (with certain technical exceptions) by the Pharmacy and Medicines Act, 1941. The Cancer Act, 1939, contains similar provisions relating to cancer.

The legal position of osteopaths was considered in *Hall v. Trotter*.[1]

In *R. v. Ensor* (1932) the Recorder of London said that the medical profession had no monopoly of the healing art. He said that osteopaths and others had professed the healing art in various directions, with "a perfect right to treat patients every bit as much as any qualified doctor, so long as the public knew with whom they were dealing". In 1932 and 1933 several osteopaths were fined for describing themselves as "osteopathic physicians and surgeons" or as "manipulative physicians and surgeons" contrary to the Medical Act, 1858. There seems to be no legal objection to osteopaths describing themselves as "doctors", provided they do not pretend to be registered medical practitioners.

QUACKERY

Quackery must be considered as a subdivision of malpraxis. Medical evidence is sometimes required when a blatant quack has overstepped his limits; where, for example, he has signed a death certificate.

The usual way in which the law deals with quacks is by means of a prosecution for obtaining money under the false pretence that they are duly registered medical practitioners. Prosecutions are reported in the medical press from time to time.

The position of "quacks" was well stated by the judge's summing-up to the jury in the *Indian Oculists' Case*, in 1893, thus:

"If you think these men deliberately performed these operations with the full knowledge that what they were doing was useless, unnecessary, and cruel, as the skilled surgeons tell you, you cannot resist the conclusion that the intention they had was to defraud. If you think that this is not established, then they are entitled to be set free."

As "quacks" they had no ability to raise the presumption that *prima facie* they were skilled and competent. They had to commence their defence *ab initio*. The following are classes of cases in which a charge of gross negligence has been sustained: Where recklessness, stupidity, or manifest ignorance in an essential matter has been displayed, or where some wilful injury has been effected, e.g., by way of experimentation, or by treatment otherwise than for the patient's benefit, or by treatment when the practitioner was not

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[1] (1921), 38 T.L.R. 30, where the High Court held that the Medical Act, 1858, s. 32, does not apply to manipulative treatment such as services rendered by an osteopath who does not advise and prescribe. See also *Macnaghten v. Douglas*, (1927) W. N. 156.

in a sober condition. It has been established that one may not experiment on a patient, or, rather, that one experiments at one's peril.

Quackery does comparatively little harm so long as adults consult quacks of their own free will; but the matter becomes much more serious when helpless children are consigned to the care of faith-healers and others. The law seems utterly powerless to check this practice.

CHRISTIAN SCIENCE

Christian Science, a cult founded by a Mrs. Eddy in 1883, has a great number of adherents. It is a religion as well as a medical cult. Christian scientists do not believe in the existence in fact of pain or sickness and consider that only the belief in pain really exists. They therefore treat all maladies as phenomena curable by faith. They do not believe in the action of drugs or in the tenets of orthodox medicine.

There have been many cases where persons have died owing to refusal to obtain medical advice or treatment, and so far as any individual is concerned it is his own affair whether he obtains treatment or not. The case is otherwise when a person responsible for the health of another refuses to obtain medical treatment and when death results owing to the lack of such treatment. In these cases the parent or guardian may be prosecuted for neglect, but the fact that a patient died, not as a result of something which the Christian Science practitioner did, but as a consequence of something which he did not do, makes it difficult to prove a charge of manslaughter or culpable homicide.

had no bearing on the case except as showing the good faith of the prisoner. In deciding the first in the affirmative the Hon. Charles Moss, *Chief Justice of the Court of Appeal, Ontario*, laid down that "what is included in necessaries is to be determined upon the circumstances of each case, and whether there has been neglect to supply them must also depend upon the circumstances". This would protect the parent who, believing his child's case to be of a trifling nature, did not consider medical aid to be necessary, although, in fact, it was necessary, and would leave the jury the question whether in all the circumstances of the case "medical assistance and treatment were necessaries proper to be provided for the child, having regard to the state and condition in which the evidence showed him to be". With regard to the evidence of "Christian Science cures," the learned Chief Justice held that they were properly excluded from the jury's consideration upon the main issue as to whether necessaries had been provided or not, and that as the good faith of the prisoner was not in question the evidence could not have been received at all. This eminently sensible and satisfactory decision should result in the saving of an appreciable number of children from death or injury to their health at the hands of "Christian scientists" and other absurd but dangerous people, although the section of the Code which it interprets does not go so far as the British Act, which makes penal the causing of "unnecessary suffering". But the decision in *R.* v. *Lewis*, the case before the Court of Ontario, and that in *R.* v. *Senior*, referred to above, are, however, no more than we were entitled to expect. A serious slur would be cast upon medical science in the present day if our law courts refused to recognize its aid as necessary in cases of serious illness or injury where relief is desired, or denied its power to alleviate suffering.

Statutory recognition is now given to "Christian Science" in England, for by the Public Health Act, 1936, the Minister of Health is empowered to grant exemption from the operation of the Act in respect of any nursing home which is or will be carried on in accordance with the practice and principles of the body known as "the Church of Christ Scientist".

HYPNOTISM

The practice of suggestion, as old as ancient China and Egypt, has passed through phases of auto-suggestion (mesmerism—after Anton Mesmer of 18th century Paris) to hypnotism as first clearly defined by Charcot. It is used in the treatment by suggestion of many conditions of ill health including states of depression and other mental disorders. It has also been used instead of an anæsthetic in certain manipulative and operative procedures and in child-birth. The induction of hypnosis if in the right hands is safe enough and cannot be considered improper.

Unfortunately, the bizarre effects which can be produced by suggestion lend themselves to public exhibitions which are not without their dangers.

In December, 1948, a girl of 19 went to a "variety programme" at Brighton, where she took part in a stage exhibition of hypnotism given by a Mr. Ralph Slater: Slater said it would be harmless. She was easily put into a hypnotic state, but on being left for a moment appeared to be coming round. Slater ran to her, put both hands on her neck, moved her head forward and, in a very commanding voice, told her to sleep. She relapsed into a "deeper" trance.

Slater told her her chair was getting hotter and she would soon be unable to sit on it, whereupon she jumped from it. Then he said "You are going to feel like a little baby and you will want your mother and will cry badly." The girl started to cry bitterly and shouted "Mummy, Mummy, Mummy." Slater later told her she was going to wake up and she did so. For a week after she felt normal, then started to have bouts of depression, often starting by her waking up feeling very frightened. In the autumn of 1949 she consulted doctors, and in 1950 she underwent a four-month cure by hypnosis.

An action for negligence and assault (the placing of the hands on the neck) was heard before Mr. Justice Croom Johnson at Lewes Assizes in March, 1952, and

resulted in an award of £1,000 for negligence and £25 for assault, together with special damages of £107. (*Rains-Bath* v. *Slater*, Lewes Assizes, 1952).

The Hypnotism Act, 1952, subsequently made such public exhibitions illegal.

The question whether a hypnotized subject might be tricked into doing some immoral or dishonest, even felonious, act is an important one. Ericksen[1], attempting such suggestions on 50 test subjects, found that they awoke rather than carry out some repugnant act.

It is possible that hypnotism may be used for psycho-analytical methods of extracting information which would be withheld by a fully conscious and resistant subject but it is a method upon which the law would undoubtedly frown: evidence so obtained would not be admissible.

[1] Quoted in J. R. Rees, 1949, Modern Practice in Psychiatric Medicine. p. 591. London: Butterworth.

CHAPTER IV

IDENTITY

IDENTIFICATION OF LIVING PERSONS AND HUMAN REMAINS

THE necessity for the identification of individuals is a matter of every day occurrence throughout our criminal and other courts, and cases of mistaken identity do occur from time to time; none has been so notorious as that of Adolf Beck in 1903–4, in which it was fully recognized that a mistake was made. An account of the legal difficulties in the case appeared in a leader in *The Times*, August 19th, 1901. The points relied upon for identity seem to have consisted chiefly in the general likeness of hair on the face, similarity of features, etc., so far as the common witnesses were concerned. On the scientific side identity of handwriting was the chief point relied upon. On the medical side the principal fact was that Beck had not been circumcised, and was therefore not a Jew. It is on the legal side, however, that the principal interest of the case centres, for the medical evidence (as also a perfect *alibi*) seems to have been ignored or ruled out of court. The fact remains that an innocent man suffered penal servitude through mistaken identity, and that this arose not from *medico*-legal defects, but through legal technicalities and police obstinacy, and need not, therefore, be given in detail here.

The factors to be considered in connection with identification and the questions that may arise in connection therewith are very numerous. Some can be answered only by a medical man, some lie more in the province of a detective, while others can be attested by any observant witness. Most of these points have other important connections in legal medicine, but there is no link other than identity which connects them, and they will, therefore, be considered here in this connection.

Before mentioning any details, attention must be drawn to a principle of probabilities in logic or evidence; it is the "law" of multiplicity of evidence, and may be thus stated:—Supposing one witness or fact testifies to a certain thing, or points to a certain conclusion, then if a second *independent* witness or fact testifies in the same direction the probability of the conclusion being correct is more than doubled; and if a third *independent* person or piece of evidence corroborates the first two, the probability of the conclusion being correct has a yet still higher multiplying factor, and in ordinary cases may be accepted as a certainty. This principle has a wide field of application in all medico-legal questions.

Identification may be required in respect of:—

    (a) A living person or one recently dead.

    (b) Mutilated, decomposed, or fragmentary remains.

    (c) Skeletal remains.

The means available for identification are as follows:—

Intellect and memory. Education. Speech, language, accent. Gait. Mannerisms, tics. Handwriting.	These can obviously be used only in relation to a person actually living at the time of inquiry.
Complexion. Racial colour. Likeness of features. Occupation marks. Clothes, jewellery and articles in pockets. Race. Deformities, birth marks, peculiarities of nails, etc. Injuries, scars and tattoos. Anthropometry (Bertillon's system). Dactylography (the finger-print system). Stature, weight. Sex. Age. Teeth, dentures. Hair. Blood.	Of these, some can be used in the living or the very recently dead, others in those dead for a longer time. Many of these points have interest other than that of mere identification; they will be discussed fully here to avoid repetition.

Intellect, Memory, and Education

These three features of personality require no detailed discussion for they come within the province of the ordinary intelligent witness. They assumed a very high degree of importance in the cross-examination of the claimant to the Tichborne estates in 1872 and 1873 (see pp. 107, 109). The intention of counsel was to show that the claimant was a man of poor mental power, inferior memory, and slight education, while the real Roger Tichborne was a man of good mental capacity, fair memory, and well educated.

Deterioration of intellect, loss of memory and acute disorientation of the mind must, of course, be accepted as possible explanations for such changes in character.

wide apart: *speech somewhat as though his tongue was too large for his mouth; is a boaster*".

To recognize a person by the voice alone would be a risky proceeding in a criminal charge, though it is often enough accepted upon less important occasions. The *timbre* of a voice, which constitutes the means by which we perhaps, unconsciously judge voices, depends very largely on the number and character of the overtones, and these may easily be altered by disease or accident, or, of course, deliberately.

There are certain kinds of speech dependent upon nerve diseases, e.g., disseminated sclerosis, bulbar palsy or general paralysis of the insane, upon which a medical opinion might be asked in a court of law, but they belong too much to the domain of general medicine to require further notice here. We must note how prosthetic dental work, dentures in particular, may alter a voice.

Gait and Mannerisms. Tics

We are constantly in the habit of recognizing friends and aquaintances by the character of their gait and from certain mannerisms. Lameness or other disability in walking might require a medical examination to elucidate its cause, especially if malingering were suspected. Ways of sitting, leaning, moving the hands, movements of the body, shrugging of the shoulders, movements of the facial muscles, brows, etc., are often characteristic and difficult to disguise for any length of time.

At the trial upon a charge of murder held at Winchester Assizes in 1952 (*R. v. Wattam*) much of the circumstantial evidence revolved round the hawking by accused of the dead woman's toilet set piece in silver and enamel. The man who had appeared at a jeweller's in the town next day had used a false name in discussing the sale of the stolen article, but was described as having *repeatedly swept back his hair with the left hand*. The jeweller remembered him effecting a previous sale under the name of Wattam—reminded partly by this habit of stroking back the hair. Even during trial, accused, whilst denying this identification, could be seen by the jury to be repeatedly stroking back his hair with the left hand.

Handwriting

The study of calligraphy can scarcely be considered one of the branches of medical jurisprudence.

It is essential, however, that the medical jurist should have a certain knowledge of the scope of this subject, so that he may not fall into the common error of assuming that all handwriting experts are unreliable. The trouble arises from the fact that a number of people who study merely the superficial characters of writing are quite prepared to give an expert opinion as to the authenticity or otherwise of a document, and, as a general rule, the less the knowledge of such persons the more didactic they become in their statements. It is this that has brought the handwriting expert into disrepute.

In the examination of documents to ascertain whether two samples of writing are by the same hand, the documents must be patiently searched for certain peculiarities in the formation of letters, the manner in which the upstrokes and downstrokes are formed, characteristic methods of joining certain letters together, and so on. These peculiarities are then searched for in the second sample, and if the two are by the same hand it is practically certain that a number of the same peculiarities and characteristic forms will be found. Of course, these must be in sufficient number and sufficiently out of the ordinary to exclude the possibility of a chance relationship. The

greater the number of words to be compared, the greater the chance of the expert to detect similarities; where there are only a few words written it is often impossible to give any decision.

The subject has become of great importance since the examination of documents, ink, etc., has passed into the hands of those qualified to examine them, and, though the science can never attain the state of certainty of finger-print identification, it has great possibilities. The detection of forgeries and additions to writings made at later dates has been made easier by infra-red and ultra-violet photography, but this more exact science has nothing to do with identity problems and will not be discussed here.

Complexion

This is an important identity feature in the living and in the recently dead. The racial differences between the extremes of skin colouring are marked enough, but vital shades like pale, florid, sallow, etc., tend to disappear or alter soon after death. Organic changes in the skin, such as freckles, pimples, etc., are more enduring, and are likely to be recognizable for some little time after death, provided decomposition has not advanced very far. In judging the colour of the complexion it is most important that the individual, alive or dead, be examined by ordinary daylight, for in the usual forms of artificial light, with a large preponderance of yellow rays, the finer shades of skin colour are quite indistinguishable; even deep jaundice cannot be appreciated without great difficulty.

Von Luschan's skin colour tablets, used in anthropology, are particularly helpful in determining racial identity.

Likeness of Features

During life the general expression of the face can be so readily altered that mistakes can easily be made. The notorious Charles Peace, who was executed in 1879, was so clever at disguising his features by voluntary movements that he was said to be able to converse without discovery with detectives who knew him. After death such voluntary alteration is, of course, impossible; but death so speedily alters expression that too much reliance must not be placed upon this mode of identification. Photography is notoriously an unreliable method of identification unless minute details are considered.

The identification of persons by sight alone leads to endless mistakes in ordinary life without any particular inconvenience, but such mistakes occasionally occur in connection with criminal identification with possibly serious results.

In 1953 the photograph of a man "wanted for interview" by the police in connection with a murder in Kent was televised—for the first time in English police history. Scores of people "saw Pettit" during the next few days, some simultaneously in places hundreds of miles apart. He was, in fact, already lying dead in Lombed-out City premises.

It is common experience that the average truthful witness is absolutely unreliable in the majority of cases when asked to identify a certain individual whom he is supposed to have seen. Nearly every person has others who are more or less like him, and occasionally this resemblance is so startling that it is impossible to recognize the difference between the two people when seen apart. A good example of such resemblance is seen in the famous Fox Twins,

	Measurements			Measurements	
Head Length	19·7	Head Length	19·5·3		
Head Breadth	15·5·5	Head Breadth	15·7		
Left Mid. Finger	11·2	Left Mid. Finger	11·3		
Left Cubit	25·6	Left Cubit	45·7·5		
Left Foot	25·2	Left Foot	24·1·5		
Five Breadth	5·1	Five Breadth	11·1·4		
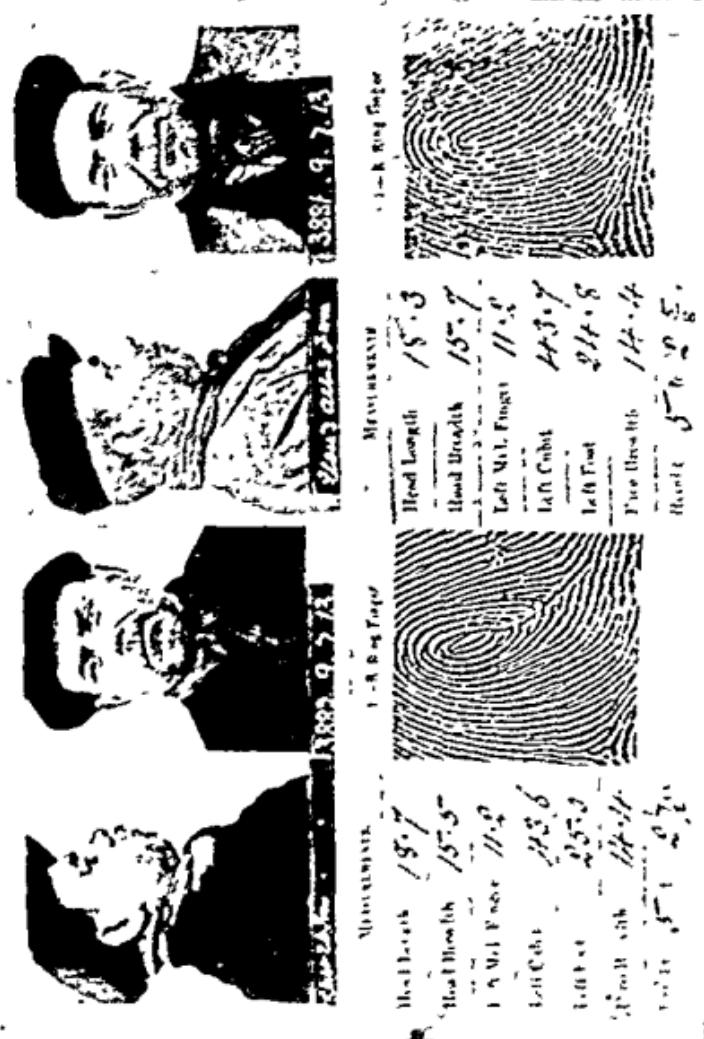
Fig. 1. The notorious Stevenage (Herts) twins, Albert Ebenezer (L) and Ebenezer Albert Fox (R). The former had a substantial criminal record, the latter being a white mule, creating alibis by his similar appearance. The only secure means of distinguishing the two has their fingerprint record. See front and back. *By courtesy of The Commissioner of Police in the Metropolis and The Editor, Police Journal.*

but a more remarkable case is that of two men quite unknown to one another and unrelated (Figs. 2 and 3) who were in the same prison at the same time,

FIG. 2. Photograph of Will West, No. 3126, of the U.S. Penitentiary at Leavenworth.

FIG. 3. Photograph of William West, No. 2610, of the same Penitentiary. These two men were in prison at the same time. Their finger prints were, of course, different in innumerable respects.
(*After Wilder and Wentworth, "Personal Identification", p. 31*).

bore the same name, and had practically the same Bertillon measurements.

These examples serve to show the great danger of sight recognition in criminal identification. In other instances the same individual may be completely changed by modifications in the method of trimming the moustache or beard, or by shaving, as seen in Fig. 4.

Fig. 4. Two photographs of the same person. The first was taken in November, 1908, and the second in December, 1909. (*After Wilder and Wentworth, "Personal Identification".*)

bodies, a clue to their last whereabouts or a link with a person suspected of crime.

Apart from the above, evidence of the social status, habits, etc., of the person may be obtained from the general condition and state of the clothing, its obvious value, cut and finish. The cleanliness of the clothing and skin and the care which has been taken with the nails, teeth, hair, etc., may be points of value.

(*b*) More permanent organic changes, which may receive brief notice here. They are, generally speaking, of more value when the body of an unknown person is found under suspicious circumstances than in questions connected with *living persons, though in the latter they may afford useful evidence corroborative or otherwise of the tale of a prisoner.* The horny-handed son of toil can be thus easily distinguished from one who has not performed much manual labour; the callosities on a bricklayer's thumb, those on a harpist's fingers, are examples of more particular trades, as also are anthracitic stigmata in coal miners. In modern tradesmen there is less tendency to the formation of trade marks or deformities, but if an unknown body is being examined, all marks resulting from occupation should be described and photographed.

Clothes, Footwear, Jewellery and Articles in the Pockets

The clothes are nearly always of value, although manufactured in large quantities of identical nature, and should be preserved with the greatest care. The name of the tailor or maker on the tags or buttons of the clothes, the presence of laundry marks[1], dyers marks or repairs, should be recorded at

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[1] In both England and the United States laundry marks are now more commonly made with "invisible" inks and sorted under ultra-violet light. All clothing should be examined for identity marks in this way.

once. Watches frequently have private marks inside the cases made by the watchmakers who have carried out repairs. All contents of pockets must be recorded and filed with great care.

In 1953 a man named Pettit, "wanted" by the police in connection with a murder in S.E. London, was found dead in bombed-out City premises, and identity had to rest with clothing, papers therein—and teeth. A letter beside the body was identified as in his writing and a card bearing the wanted man's name was found in the jacket pocket: it referred to dental treatment at Guy's Hospital, giving a file number from which X-ray and other dental data exactly comparable with those of the dead man were obtained. They bore the name "Pettit".

At an inquest held at Southwark in September, 1953, a man's body recovered from the Thames was identified by:

- (a) Clothing including a shirt marked L.254—a laundry mark similar to that of the landlady whose lodger the dead man was thought to be.
- (b) Underclothing similarly marked in the lodger's chest of drawers;
- (c) A key in the jacket pocket which fitted the lodger's door;
- (d) The general features of sex, age, height, hair and skin colouring. No distinguishing feature was present.

A bank book, ration book, N. I. card and identity card still lay in the vacant room: they remained unclaimed.

Warning should be given against accepting laundry marks on small articles as evidence of identity; handkerchiefs, etc., are easily transferred or misplaced, and are unsafe clues.

In *R. v. Heath* (C.C.C. 1946) the ankles of the victim of a sadistic sex murder, Marjorie Gardner, were found to be tied with a handkerchief embroidered with the letter "K" and laundry marked "L. Kearns". No one connected with the case had such a name.

Race

This is a method of identification which is not infrequently of use in seaport towns. The hair (*vide* under "Hair"); the skin,[1] black in the Negro and some other races, dark brown in Indians and some other aboriginal races, yellow in Mongolians; the lips, varying in thickness and shape, are all useful for identification if decomposition has not proceeded too far. If bones alone are found, racial identification is extremely difficult and should not be attempted by the ordinary practitioner. The help of a skilled anthropologist should be obtained in all cases.[2]

A careful examination of skeletal remains quite frequently enables the expert to arrive at fairly precise information concerning old disease malformations and injuries which often lead to a personal identification. Cases of this sort, in which blindness in one eye, wry neck, paralysis in the leg have been diagnosed, have been published.[3]

Asymmetry of the Body
Deformities and Birth-marks

Developmental stigmata are most important, and must be very carefully noted in the external examination of a dead body as well as in describing the person of a living individual. Moles, naevi, port wine stains, are all distinctive marks, easily seen on babies and young children, noted and

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[1] The skin tints may be measured more accurately by using Von Luschan's skin colour tablets.
[2] *Vide* Trevor, J. C., 1950. Chambers Encyclop., II, 424.
[3] Smith, S., 1939. *Police J.*, 12, 3, 4.

the time of birth of a fine pattern of ridges on the skin of the balls of the fingers and thumbs, parts of the palms and the soles of the feet. These patterns have a major design (shown in Fig. 6) which enables them to be placed in groups for primary classification, and a considerable amount of finer detail—of branching and coalescence of ridges, of island, core and delta arrangements permitting sub-grouping, and an unlimited quantity of extremely fine pore details along individual ridges. The Henry, Conlay Fleck or Battley "single-print" systems refer to police methods of classifying such records in such a way as to make them easy to refer to for the puposer of comparison.

Classification. These details enable fingerprints to be classified primarily (as in Fig. 6) as loops (about 67 per cent) of which all but some 5 per cent are "ulnar", i.e., open out towards thé ulnar border of the arm, whorls (about 25 per cent) and arches (6 to 7 per cent) or more composite forms comprising the remaining 1 to 2 per cent. Line tracing and counting enables these main groups to be broken down into sub-groups, and final identification is effected by a study of ridge pattern.

In practice 16 to 20 points of fine comparison are accepted as proof of identity, but, of course, an unlimited amount of detail is available in any small area—even a small part of a single print. Details of these can be accurately teleprinted for comparison in modern crime-file departments. so that a search of the records, a comparison and a reply need take only a few hours. The details that are present at birth remain for the rest of the individual's life, unalterable, capable of defacement only at the expense of a series of new identity data—the scars left when the defacing injuries heal.

Palm and foot prints may also provide similar material for comparison.

In April, 1912, an old pawnbroker was found suffering from head injuries near a rifled safe in the basement of his shop at Shoreditch, London: he died several days later. A single palm print on the safe door led to the conviction of two men who had planned a raid of this calibre—though possibly never intending murder. (*R. v. Dashwood & Silverosa*, C.C.C., 1912).

A safe robbery occurred in Lanarkshire in 1952 and examination of the premises revealed some bare footprints in a film of flour on a hard floor. On the safe two further prints were found, and one of these showed clear ridge details of a great toe. About a month later a well-known safe blower was arrested on enclosed premises, and taken into custody. He was cautioned and charged with the safe blowing robbery: prints of his bare feet gave an exact comparison (from the left big toe) with the print found on the safe at the scene: 22 points of similarity were noted. A conviction followed[1].

Footprints are also used in American maternity hospitals as a means of identifying the babies of maternity cases which might be inadvertently mixed.

The individuality of the Fingerprint. The credit of introducing the fingerprint to crime records undoubtedly lies with two Englishmen, Dr. Henry Faulds, who first published an account of the method in a letter to Nature on October 28th, 1880, and to Sir William Herschel. Faulds was undoubtedly aware of the importance not only of the ten finger records for identification but also of the possibility of recognizing chance impressions or identifying mutilated remains in this way; unfortunately, Herschel claimed a precedence for using the method of some 20 years, and had, it would appear, submitted a report in 1877 asking that the method be used as a means of identifying prisoners. An acrimonious dispute over priority achieved no decision, but it appears that Faulds should be given priority. It remained

for Sir Francis Galton to prove the individuality and permanence of the fingerprint and to devise a classification for criminal records which was later simplified by Sir Edward Henry of New Scotland Yard.

No doubt can possibly be entertained, as experience has increased, but that the finer ridge patterns emphasized by Locard as being so individual are in fact so—and permanently so.

FIGS. 6–8. Finger and foot-print clues left in a hospital ward by an intruder who snatched a child from a cot and murdered it in the hospital grounds. (*R. v. Griffiths*). Courtesy of *The Chief Constable, Lancashire.*

FIG. 6. A winchester bottle bearing finger prints (made observable by dusting with powder).

As a part of this enquiry all English, American and available European records vere also searched for this print: no similar print was found.

Galton estimated the chances of similar prints from different fingers as being something like 1 in 64 thousand million: it was a speculation. It is more significant to remark that never yet in the world's crime records—as many as 120 million in Hoover's F.B.I. office at Washington alone—have two identical fingerprints been seen, unless from the same finger.

Techniques of Fingerprinting. Fingerprints may be impressed on to some relatively soft material as *moulded impressions*, requiring only suitable lighting for photographic reproduction. They may also be *visible* owing to the contact of fingers coated with some foreign colouring matter, as in those made for police records. The vast majority of prints encountered in criminal investigation are, however, not plainly seen until they have been revealed by brushing with some contrasting coloured powder or "developed" by means of some chemical like osmic acid or silver nitrate.

These "latent" reproductions of the ridge characters are due to the moistening of the skin by sweat and sebum from the skin glands. A smooth dry surface touched firmly without sliding will reproduce a mirror image of the print in sebum: a fine powder like white lead, powdered aluminium or hydrarg. c.Creta (or for light coloured surfaces lamp-black or red oxide of lead) dusted with a soft brush will "develop" or reveal these so that they may be photographed. Should photography not be practicable, the print may be "lifted" on to cellophane tape applied with great care and then peeled gently away.

Cardboard and papers, such as anonymous letters, into which the greasy sebum may become absorbed may be treated with iodine fumes, silver nitrate (reacting with the salts) or osmic acid (reacting with the fatty substances of the skin). Treatment with 1 per cent $AgNO_3$, drying, and then developing with metol-quinol (fixed by hyposulphate) appears to be satisfactory.

An interesting method by which latent prints on paper may be developed has been described.[1] The paper is sprayed with a 0.2 per cent solution of ninhydrin in acetone followed by heating at 80°C. for a few minutes. Development of a pink coloured print continues for some time after removal from the oven and the prints attain their greatest distinctness a day or two after treatment.

The test is due to the deposition of free amino acids from the skin on to the surface of the paper.

Peeling finger pads in victims of immersion in water or of decomposition may be photographed by transmitted light or "reversed". Dried skin may be restored by immersion in 1 per cent caustic potash.

Uses of Fingerprints in Practice. The principal uses to which fingerprints have been put are:

To maintain identity records (service or criminal);

To identify a print left at a scene of crime—to associate the scene (or a weapon) with a suspect;

Fig. 9 illustrates the use of the print, in this case of the palm of the hand, as evidence of who held the weapon in cases of stabbing and other similar woundings. Accused, a coloured man, stabbed two fellow countrymen in an East London café in 1953. A knife, identified as his, left at the scene of the crime, bore his right palm print, undisturbed. He was convicted of manslaughter. (*R. v. Abela*, C.C.C., 1953).

[1] Odin, S., and von Hoasten, B., 1954. *Nature*, 173, 449.

In 1949 a man broke into the house of a well-to-do recluse in Maidenhead, binding, gagging—and suffocating—the old lady who threatened to disturb his crime: the body was placed in a travelling trunk where it was found upon search two days
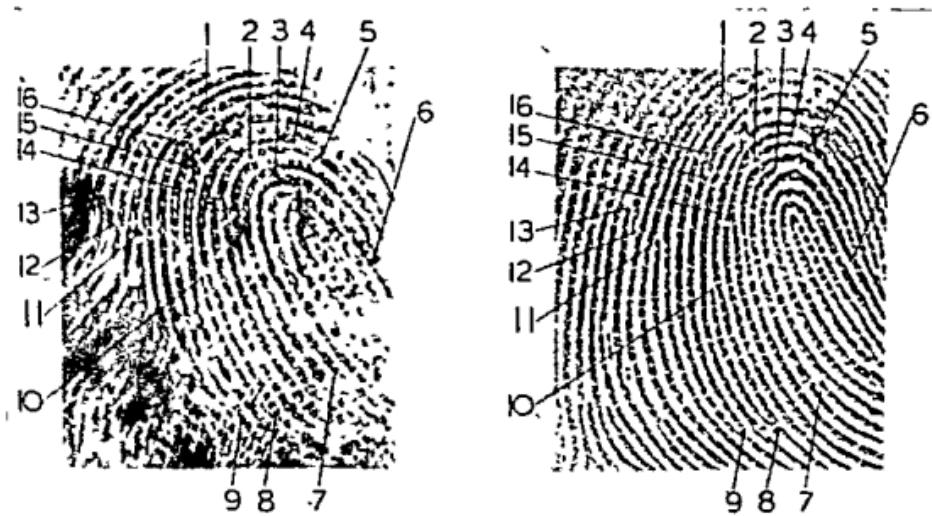
Fig. 7. Enlargement of 1324/48N on bottle compared with right finger print of suspect.
(*Vide* Fig. 6)

later. A solitary fingerprint was found on the lid of a jewel box discarded in a living room, and search in the files showed that it was from a C.R.O. file man called Russell. He was traced, arrested and, on being taken into custody, found to be wearing a scarf knitted by the old lady he had murdered. Conviction followed. (*R. v. Russell*, Reading Assizes).

To identify a missing person:

The victim of the Luton Sack murder[1] was identified after three months fruitless house-to-house visiting, showing of photographs, and circulation of identity data including edentulous jaw casts, by a dyer's tag in a piece of cast-off clothing. This led to an address from which a woman had disappeared at about the time of the murder. A pickle jar lying on a shelf leading to a cellar bore a fingerprint identical with that of the victim (recorded at the time autopsy was made three months previously). It was in remarkably good condition in spite of its age.

To identify human remains:

A case has been recorded[2] in which an intruder at night, disturbed by a woman screaming, clapped his hand over her face but had the top of his index finger bitten off. Ten days later a man was arrested and found to have a complementary finger, mutilated by rough "amputation" of the top. Accused happened to state that he had previously been arrested on a false charge and reference to the records showed a right index fingerprint identical with that bitten off by the woman (Fig. 10).

Under the Criminal Justice Act, 1948, any person over 14 years old who is in custody charged with an offence before a court of summary jurisdiction may, on the order of a police officer not below the rank of Inspector, have his fingerprints taken irrespective of consent. In Scotland common law assent for the same procedure has existed for many years.

The detailed technical aspects of fingerprinting and of the development and photography of latent prints may be further explored in the following writings on the subject:

Bridges, B. C. Practical Fingerprinting, Funk & Wagnall. New York, 1942.

[1] Simpson, K., 1943. *Police J.*, 18, 263.
[2] Smith, S., 1940, *Police J.*, 13, 148.
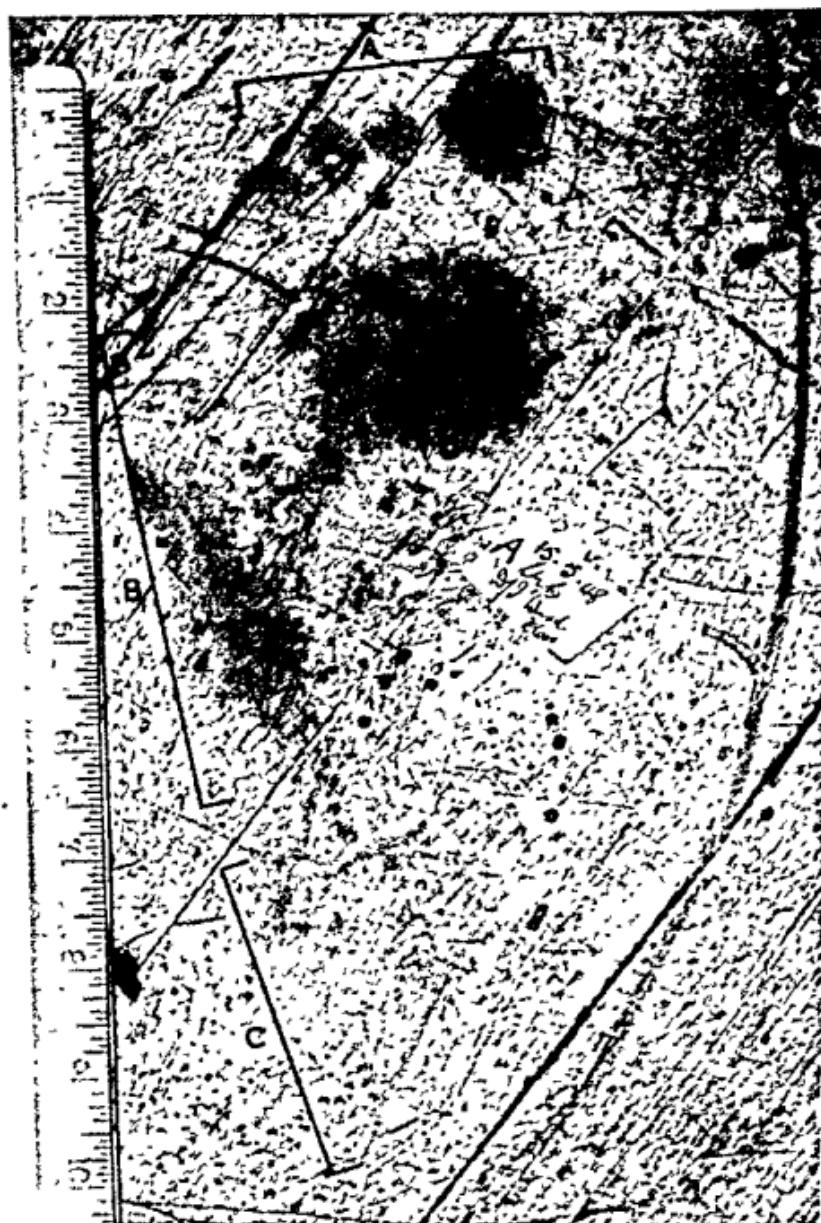
FIG. 8a. Photograph of left foot mark on ward floor.
(*Vide* Fig. 6)

Labels on figure: A, B, C

LEFT STOCKINGED FOOT
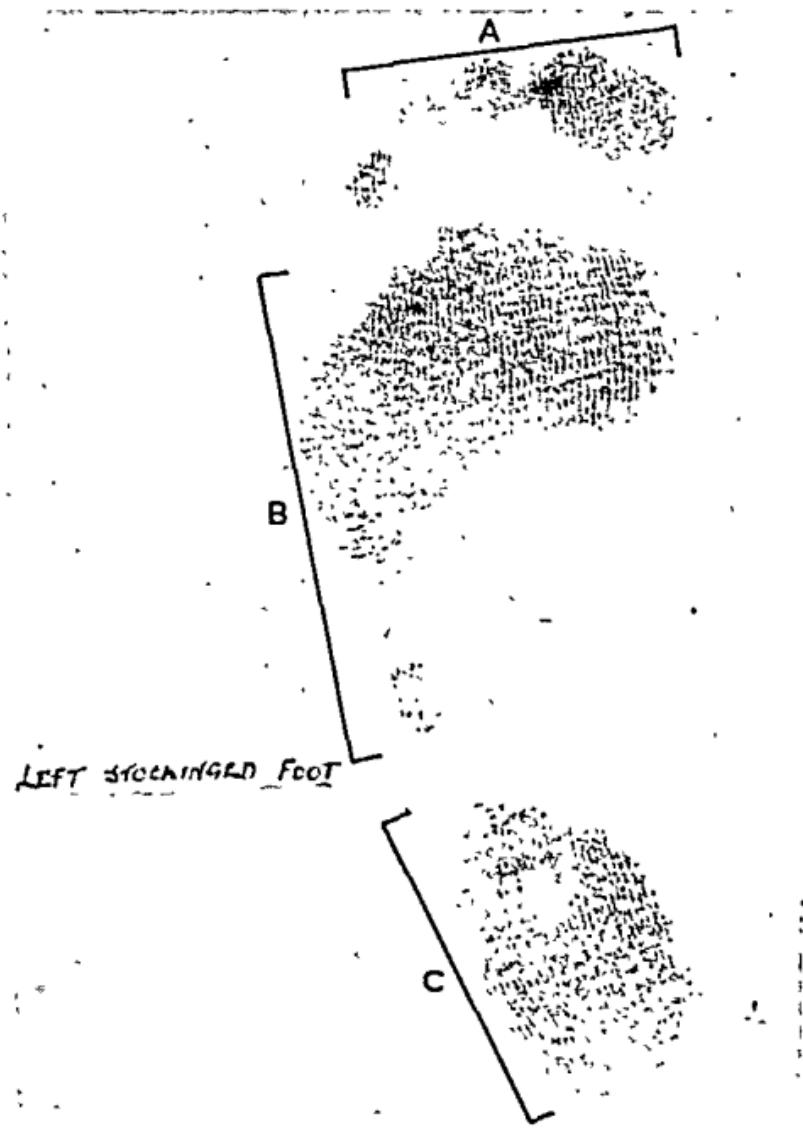
Fig. 86. Photograph of left stockinged-foot on form signed "Peter Griffiths".
(*Vide* Fig. 6)
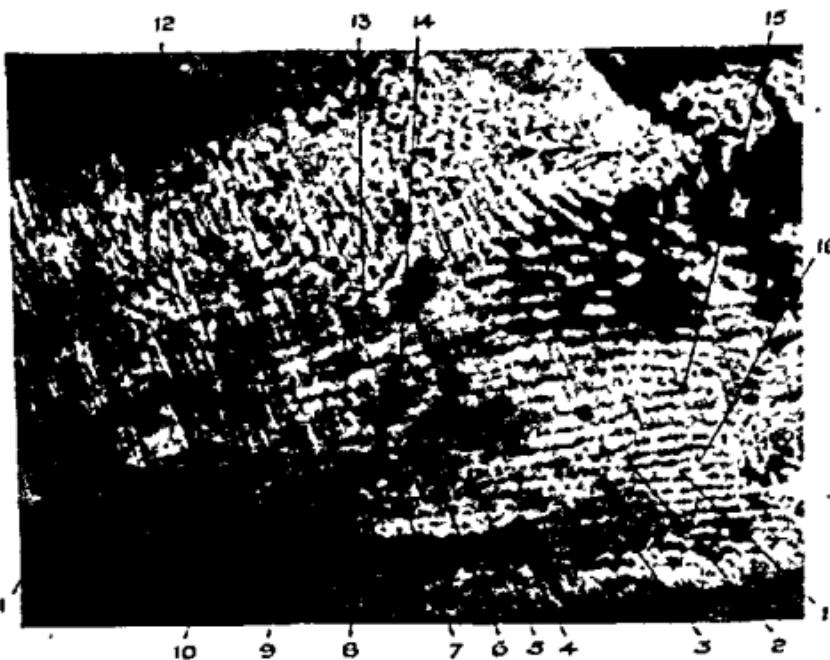
Fig. 9a.
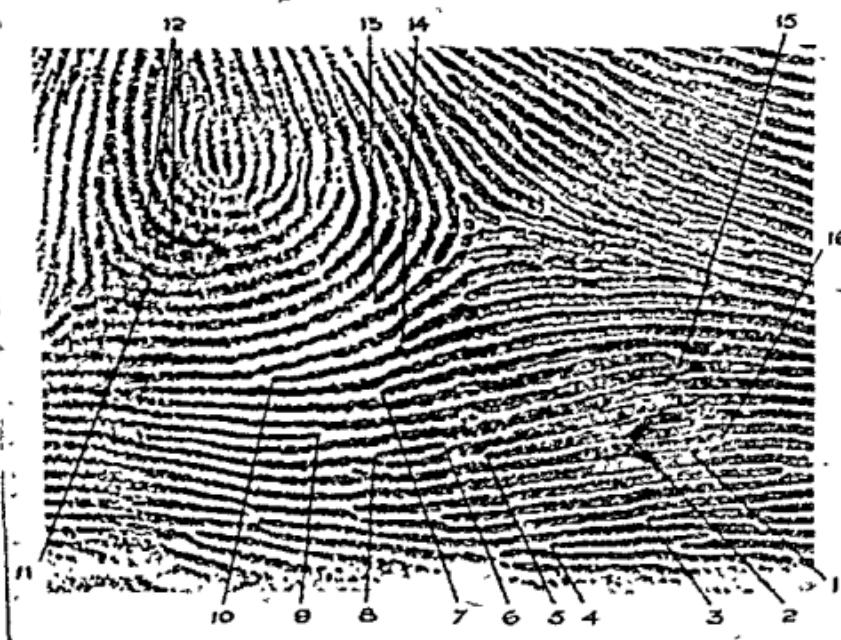
Fig. 9b.

FIG. 9.   Bloodstained palm-print on blade of knife (a) alleged to have been used by accused to commit murder, together with comparison print (b) showing fine ridge marking, from palm of suspect.   (R. v. Abela).

(Courtesy of Commissioner of Police in the Metropolis).

Fig. 10a. Identification of a man wanted for robbery with violence by means of the fingerprint. The tip of the finger was bitten off by a screaming woman, over whose face the man clapped a hand, and left at the scene of the crime. A similar print lay filed in the criminal records office. (Fig. 10b).[1]

Fig. 10b

Hoover, J. E., 1945. Classification of Fingerprints. U.S. Government Printing Office. Washington.

Cherrill, F. R., 1954. The Finger Print System at Scotland Yard. London. H.M. Stationery Office.

Campbell, C. Latent Fingerprint Developers. *Police J.*, 1950, 23, 143.

[1] Smith, S. 1940. *Police J.*, 13, 2.

Stature and Weight In Identification

If it were not that the obvious is so often overlooked, one would say that in the living or recently dead these two points were too obvious to require mention. Exact measurements of both should be made and recorded wherever possible[1].

In works on physiology, when the subject of growth is under discussion, tables of increase of length and weight according to the age are commonly inserted, but they have very little medico-legal interest, for they deal only with averages, and it is common knowledge that exceptions are frequent. Evidence from a witness regarding a person whom he had known some time before, as to height and weight must be accepted with caution.

About 1·2 in. in men and 1·5 in. in women, can safely be subtracted from any stature measured in footwear (Boyd and Trevor)[2]. Further, the height undoubtedly diminishes during the day: Morant[3] estimates this "settling down" to average about 0·5 in. to 1·0 in. by the end of the day.

It has also been shown that Manouvrier's 60 year old statement that the corpse length was as much as 2 cm. more than the living stature is, in fact, true.[4] These things must be taken into account when taking statements as to height for identity purposes.

The subject of estimation of stature from fragments of a body, and from bones, possesses very great interest, and will be found fully discussed under "Identity of Bones" (p. 145).

TEETH

The teeth, under natural conditions of decomposition, are practically indestructible. They therefore offer over an almost unlimited time an excellent means of identification. In infancy and childhood they are fairly regular in their development and appearance, and thus afford also a very useful criterion for the estimation of age in young subjects. We must discuss the teeth from both points of view.

The Teeth as a Means of Identity

In any case in which identity may possibly come into dispute, the exact details of the dentition of both jaws must be most carefully recorded. We may enumerate the following points:—

- (a) The number and situation of teeth present: whether deciduous or permanent.
- (b) The number and situation of teeth lost, including any evidence of how long lost.
- (c) Any peculiarities in their arrangement, e.g., prominent or the reverse, crooked or straight, crowded out of place or not.
- (d) The condition of those left, as to erosion, periodontosis, their colour and cleanliness, the presence of cavities in the teeth and the exact situation of fillings.
- (e) The presence of supernumerary or unerupted teeth.
- (f) The details of bridge or crown work, of inlays and of dentures.
- (g) The exact shape of edentulous jaws.

[1] Where a weighing machine is not available the body weight should be estimated: practice at this enables quite close approximations to be made.
[2] Boyd, J. D., and Trevor, J. C., 1953. In *Modern Trends in Forensic Medicine*, Ed. Keith Simpson, London. Butterworth.
[3] Morant, G. M., 1950. *Biology*, 16, 120.
[4] Trotter, M., and Gleser, G. C. 1952. *Amer. J., phys. Anthrop. (N.S.)*, 10, 143.

It is advisable to submit all such cases to a dentist for examination, and especially whenever impression and casts are desirable.

The following old case recorded by Taylor shows that he was very much alive to the importance of noticing these points:—

In *R. v. Ross* (C. C. C., 1831), it appeared in evidence that the deceased, Caroline Walsh, an old Irishwoman, had been repeatedly solicited by the prisoner to come and live with her and her husband, but refused. However, she at last consented, and went to the prisoner's lodgings in Goodman's Fields on the evening of August 19th, 1831, taking with her a bed, and an old basket, from which she was accustomed to sell tape and other articles. From that evening all traces of the deceased were lost. The testimony of the prisoner's son, who was the chief witness for the Crown, went to prove clearly that the deceased had been wilfully suffocated, on the evening of her arrival, by his mother (the prisoner) placing her hands over the mouth of the deceased and pressing on her chest. He deposed that on the following morning he saw the dead body of the old woman lying in the cellar of the house, and on the evening of the same day he saw his mother leave the house with something large and heavy in a sack.

Now it happened most singularly that on the evening of August 20th, the day following the alleged murder, an old woman of the description of the supposed deceased was found lying in the street in the immediate neighbourhood, in a completely exhausted condition, and in a most filthy and squalid state. On being questioned she stated that her name was Caroline Welsh, and that she was a native of Ireland. Her hip was found to be fractured, in consequence of which she was conveyed to the London Hospital, where she subsequently died and was buried. The prisoner Ross, when apprehended, asserted that this was the female whom she was accused of having murdered. Hence it became highly important, for the ends of justice, that the identity or non-identity of the two women should be clearly established.

The extraordinary resemblance of names and the exact coincidence of time and place struck every one in court; but by the examination of about twenty witnesses, the following points of difference were elicited. It was proved that they were both Irishwomen, but Caroline Walsh came from Kilkenny, Caroline Welsh from Waterford. The former (the alleged murdered person) was eighty-four years of age, tall, of a sallow complexion, with grey hair, and had (an extraordinary circumstance for her years) very perfect incisor teeth. The latter, Caroline Welsh (who died in the London Hospital), was about sixty years of age, tall of stature, dark like a mulatto, but had no front teeth, in addition to which it was deposed by a medical witness that the alveolar cavities corresponding to them *had been obliterated for a considerable time*. The witness brought the skull and jaw into court—for the body had been purposely exhumed for his examination—but the judge, Lord Denman, would not allow it to be produced, and said he would be satisfied with the witness's statement respecting the condition of the jaws.

Other circumstantial points of difference were deposed to—as, for example, that Caroline Walsh was healthy, cleanly, and neat in her person, and her feet were perfectly sound. Caroline Welsh was considerably emaciated; she was in a dirty and filthy condition; her hip was broken, her feet were covered with bunions and excrescences, and one toe overlapped another. The dress of the two women was somewhat similar. That of Caroline Walsh was proved to have been sold by the prisoner Ross to different persons; and almost every article was reproduced in court and sworn to by witnesses. The clothes of Caroline Welsh were proved to have been burnt by order of the parish authorities. Both of these women had similar baskets in their possession: that of Caroline Walsh had no lid or cover, while that found on Caroline Welsh had a cover. Last, the body of the latter was taken up from the burial-ground of the London Hospital for the purpose of identification, and it was sworn by two of the grand-daughters of Caroline Walsh not to be the body of their grandmother.

dissecting rooms in London were repeatedly searched for it. These circumstances were—first, that the relatives of the deceased swore that the exhumed body was not that of the missing woman; and secondly, the medical proof of the entire obliteration of the alveolar cavities in the jaw of the exhumed body, proving that the incisor teeth must have been lost long before death, while several witnesses testified to the presence of these teeth as a striking peculiarity in the missing woman. Even had the features of the exhumed body been obliterated by putrefaction, the non-identity would have been established by this medical fact. The prisoner was convicted.

Taylor also recorded the details of the famous Parkman case tried in Boston, U.S.A. in 1850:

> At the trial of Professor Webster for the murder of Dr. Parkman, the evidence given by a dentist, Keep, established the identity of the mutilated remains of the deceased, in spite of an attempt which had been made to destroy the jaws by fire. He deposed that about four years previously he had made and fitted for Parkman sets of artificial teeth in blocks for each jaw. He saw Parkman with those teeth in his head, for the last time, about a fortnight before his disappearance. He then put a new spring to the teeth. He recognized the artificial teeth, taken from a furnace, by *certain peculiarities about them, and also by their fitting the original plates and moulds*, which he retained in his possession. The gold plates attached to them had been melted in an assay furnace, in an attempt to destroy the head of the deceased. but the greater part of this gold was recovered, and the artificial teeth, to which the gold plates had been fastened, had acquired a pink colour from a portion of the finely divided metallic gold, showing that they had been submitted to a high temperature, but had not undergone fusion, although minute particles of gold were fused into them. The left side of the lower jaw presented a great natural irregularity. The block corresponded to this, and thus placed the identity of the jaws beyond dispute.[1]

The importance of the teeth as a means of identification of deceased persons was well shown in the case of the French Prince Imperial in 1879. The body had been so much disfigured by his assailants that identification would have been extremely difficult but that the Prince had had four small cavities in the first molar teeth filled with gold, and had met with a slight accident from a blow on the front teeth, which had made it necessary to file them a little, in order to smooth the enamel. These conditions afforded a means of identification.

In *R. v. Haigh* (Lewes Assizes, 1950)[2] the identity of the last victim of a series of "acid-bath" murders, a Mrs. Durand-Deacon, rested almost entirely with the finding, among the acid-eroded remains, of intact acrylic resin dentures. These were *recognized by her London dental surgeon who produced records to confirm this vital* piece of evidence. The dental work had included some "building up" of bite to which special attention was drawn.

In the case of *R. v. Dobkin*,[3] in which the mutilated remains of a woman were found 15 months after her murder, the dental evidence was of paramount importance. The lower jaw was missing, but in the upper jaw there were four teeth only, three molars on the right side (two of which had been stopped) and the first molar (also stopped) on the left side.

The dentist who had attended Mrs. Dobkin, the missing woman, gave a complete record of her dental state which corresponded in every detail with the dental condition of the upper jaw of the mutilated remains. Before seeing the specimen he drew a dental diagram (Fig. 7) which shews this correspondence as no description can do. He also stated that in removing the first and second premolar on the left side he had left a portion of the root, and X-ray examination of the specimen shewed these residual roots. When shown the jaw the dentist said, "That is Mrs. Dobkin's jaw and those are my fillings." A remarkable bit of evidence in identification.

[1] Report of trial of Prof. Webster, Boston, U.S., 1850. p. 50.
[2] "The Trial of John George Haigh", Notable Trials Series. Wm. Hodge.
[3] Simpson, K., 1943. *Med.-leg. Rev.*, 11, 132.

In *R. v. Gorringe* (Maidstone Assizes, 1948)[1] the evidence was that a girl had been found after a New Year's Eve dance battered to death in a yard at Tunbridge Wells. A bite mark on her right breast showed clear impressions of upper and lower front teeth with well defined spacing, lie and shape. Identical details (shown by super-imposing a transparent print) were given by casts prepared from impressions taken from accused. He was found guilty.

The Teeth as a Means of Determining Age

Two principal methods of determining the age from the teeth are available:

(a) Eruption dates for temporary (deciduous) and permanent teeth . . . from 6 months to 20 years.

(b) Microscopic examination of the individual teeth giving data for estimations from 20–60 years.

(a) **Eruption dates.** The alveolar cavities which contain the teeth are formed about the sixth month of intra-uterine life, and at birth the rudiments of the whole of the temporary dentition and of the first permanent molars may be found (by dissection or X-ray) in the jaws. From the commencement of eruption of the milk or deciduous teeth at about six months till the completion of the full permanent dentition, the teeth form a most valuable addition to the other factors by which age may be estimated. The periods of calcification and eruption (which, given reasonable health, are constant) are shown in the following table.

DATES OF CALCIFICATION AND ERUPTION OF THE DECIDUOUS OR MILK TEETH

Teeth	Calcification begins	Eruption	Calcification of Root Completed
Central Incisor . . .	5–6 months	6– 8 months	1½–2 years
Lateral Incisor . . .	,,	8–10 ,,	1½–2 ,,
Canine . . .	,,	16–20 ,,	2½–3 ,,
First Molar . . .	,,	12–16 ,,	2 –2½ ,,
Second Molar . . .	,,	20–30 ,,	3

Resorption of the roots of the milk teeth begins about the fourth year with the central incisors followed by the lateral incisors about five, the first molars about six, the second about seven, and the canines at about eight.

DATES OF CALCIFICATION AND ERUPTION OF THE PERMANENT TEETH

Teeth	Calcification begins	Eruption	Calcification Complete
Central Incisor . .	3–4 months	6– 8 years	10 years
Lateral Incisor . .	1 year	7– 9 ,,	11 ,,
Canine . .	4–5 months	11–12 ,,	12–13 ,,
First Bicuspid . .	1½ years	10–11 ,,	12–13 ,,
Second Bicuspid . .	2 years	10–12 ,,	12–14 ,,
First Molar . .	At birth	6– 7 ,,	9–10 ,,
Second Molar . .	2½–3 years	12–13 ,,	14–16 ,,
Third Molar . .	8–10 ,,	17–21 ,,	18–25 ,,

The date of eruption of the wisdom teeth is very variable. They do not usually appear before the 17th year and are more commonly erupted between the 21st and 24th years. They may never erupt, or may appear at a very

[1] Simpson, K., 1951. *Internat. Police J.*, 6. 512.

late age. X-ray examination of the gums may show the teeth in position and the extent of calcification of the roots. The roots should be fully calcified by the 25th year, even when eruption has not taken place. This proved an important feature in the reconstruction of the younger victim (Mary Rogerson, aged 20) in the Ruxton case.[1, 2]

Though disease or malnutrition may retard eruption the dates are, as a rule, a sound guide to aging up to 20-25 years.

In growing children the chances of losing teeth from decay or accident are considerable, and allowance must be made for this.

(b) Microscopic Examination. As the teeth bear the wear and tear of usage they gradually change in form; Gustafson (Sweden) and Scott (U.S.A.) have made the suggestion that these changes could be used in the estimate of age.

The age is estimated according to (i) erosion (attrition) of the crown dentine, (ii) secondary dentine formation within the pulp (iii) root resorption and canal closure (iv) degree of periodontosis, and (v) the degree of cementum formation around the root.

This examination has been found to have a certain value in the age period 25-60 years when age estimation is very difficult. The original articles of Gustafson and Scott should be consulted for further information but the reader should understand that this method of estimation requires considerable specialized experience.[3, 4]

SCARS AND TATTOO MARKS

The period of time at which a particular wound was inflicted may become a medico-legal question, both in relation to the living and the dead. The identity of a victim, and the correctness of a statement made by the accused, may be sometimes determined by an examination of a wound or its scar. If a dead body be found with marks of violence upon it, and evidence be adduced that the deceased had been maltreated at some time before his death, it may be necessary for a practitioner to state whether, from the appearance of the injuries, they could or could not have been inflicted at or about the time assigned. Evidence of this kind once served to disprove the statement made by an accused person, who was charged with maliciously cutting and wounding another. There was a cut upon his thumb, which he accounted for by saying it was from an accident that had occurred three weeks before. The medical witness declared, on examining it, that it could not have been done more than two or three days, which brought the period of its infliction to about the time of the murderous assault. This led to a conviction.

In making an examination of scars or tattoo marks the following points must be carefully recorded in written notes:—

1. Their number, exact situation, size and shape. Consistency of scars.

2. The colour and design of tattoos. Initials and any dates.

Should there be a doubt as to the presence of a scar it is a useful plan to rub the part well with the hand so as to excite the local circulation. By this

[1] Glaister, J., and Brash, J. C., 1937. Medico-Legal Aspects of the Ruxton Case. Edinburgh: Livingstone.
[2] Hutchinson, A. C. W., 1954. Dental and Oral X-ray Diagnosis. Edinburgh: Livingstone.
[3] Gustafson, G., 1950. J. Amer. dent. Ass., 41, 45. Summarized in "Modern Trends in Forensic Medicine" Keith Simpson. Butterworth, 1953.
[4] Scott, D. B., et al., reported in Gradwohl Legal Medicine, 1954

means we are able to get a stronger contrast between the natural and the adventitious colour of the part. A low-power lens should be used in cases of doubt.

Having carefully noted all the above points, then more special questions will arise concerning:—

A. Scars

Nature and Formation of Scar. When, from any cause whatever, a solution of continuity in tissues (other than the simple epithelium of the skin) is produced, repair of the injury begins at once. There is an increased flow of blood to the part, pouring out an exudate which coagulates, glues the edges together and acts as a scaffolding for the new repair tissue. There is a gradual development and growth of new blood-capillaries, together with numerous fibroblasts. While these cells and new blood-capillaries are young, the tissue which they collectively form is known as granulation tissue, and this granulation tissue fills up the wound. As the cells become formed into fibres these fibres contract and obliterate the newly formed capillaries; causing a change in colour of the scar from red to brown and finally white. The contraction of the new fibrous tissue may distort the original shape of the granulation tissue, and cause the scar to be depressed or to contract and deform the nearby parts.

A scar, then, is simply fibrous tissue containing no specialized tissues—these are too highly organized in man to be capable of repair by a reproduction of such special tissues. A scar in the skin is fibrous tissue covered with a few layers of simple epithelium that have grown over it, but there is no pigment layer; hence any distinctive pigment in a scar is an abnormality probably due to disease, or at any rate adventitious, and not part of the scar proper; in like manner there are no sweat or sebaceous glands or hair follicles in a scar, nothing in fact but fibrous tissue. A scar in liver or muscle is identical, but those in the brain are formed of glia, the connective tissue of the brain.

In the case of *R. v. Crippen*[1] the question of specialised tissues being found in an alleged scar became of some importance; and it was then pointed out that in stitching up a wound, living epithelial cells may conceivably be carried into the depth of the wound, and that a sebaceous or sweat gland or a hair follicle might thus be found in a scar. Very imperfect material for deciding the point was available in the case. An eminent surgeon shortly after the trial stated that he had seen such transferred materials in a scar, but allowing for this, there is no doubt about the truth of the statement that such tissues are not ordinarily reproduced by the processes which form a scar.

Is a Scar the Necessary Result of a Wound? Assuming that the term wound implies a breach of continuity affecting the substance of the true skin (cutis), then a scar is *always* produced in the process of healing. Slight punctures or incisions and superficial wounds affecting only the cutis, may leave no trace after a few weeks or months. In an even cut made by a very sharp instrument, especially if it is in the direction of the fibres of subjacent muscles and the parts are kept in close contact, the scar is even, linear, and sometimes so fine as to be scarcely perceptible; if the skin is white, it may be easily overlooked.

If on examining a part where at some previous time a stab, cut, or burn involving the cutis is alleged to have been inflicted, we find no scar, it is fair to assume that the allegation is false, and that no wound has been inflicted,

making due allowance for the fact that abrasions of the cuticle, or slight punctures and incisions, often heal without leaving visible scars.

If a microscopical section of the spot suspected can be obtained it should be possible to identify the presence of a scar, however small this might be.

Time required for Scar Formation. This varies according to the nature, size and position of the wound, and the vascularity of the part and the method of healing. Full consideration of these points would take too much space in a work on legal medicine, but the following propositions may be laid down as reasonable averages with which to compare any given wound:

(i) In clean incised wounds, such as those made by a surgeon, kept aseptic, the edges are firmly united in about five or six days, and a definite reddish scar formed in something under a fortnight.

(ii) In wounds which have been burned or corroded or have suppurated, healing is greatly delayed and the formation of granulation tissue proceeds very slowly within the wound, starting from the time when the tissues have begun to get the upper hand of the microbes in the struggle for existence; the time occupied by this is quite indefinite, from say a week to two or three months, according to the size of the wound and the success of the treatment.

(iii) In small wounds on the fingers, etc., as ordinarily inflicted, a scab forms in about 36 to 48 hours, and if on removal of this some granulation tissue be found or attempts at scarring, it may safely be said that the wound was inflicted at least four or five days previously.

(iv) In larger ragged wounds involving many structures caused by *fortuitous* violence no appreciable amount of granulation tissue will be found under a week, and no real scar for at least two or three weeks.

(v) The age and health of the wounded person have material influence even on these averages, though not always in the expected direction. Thus in many old people a wound will heal quickly, while in an apparently healthy person septic infection may cause much delay.

Age of a Scar. When first formed a scar looks red or bluish, and is tender. As its age increases it becomes smaller, whiter, denser, more shiny and less sensitive; but there are such wide variations in the time taken to produce these changes that even averages are of no use beyond this, that in about two months or so a scar acquires those permanent characters by which its individuality will be known during the life of its bearer. We have seen scars which after 35 years still became red, shiny, and angry-looking when local irritation was applied. When once a scar has become firm and white there are no data of a medical nature which will enable us to say when the wound producing it was inflicted, whether two, ten, or even 20 years before.

Relationship between the Shape and Size of the Scar and the Wound which caused it. It is obvious that there must be a broad general likeness between a wound and its scar. Thus a straight simple incised wound will have a straight linear scar as a rule, and this will be the nearer the case the closer the edges have been kept in apposition while it was healing, and the more rapidly it healed. If the incision was of some length so that the skin gaped, or if the wound suppurated, the scar, will probably be wider and thicker in the middle than at the ends. Wounds of irregular shape and lacerated and con-tused wounds commonly leave irregular scars, but not every little irregularity of the wound is shown in the scar, especially if of old date, owing to the contraction which tends to distort or obliterate small irregularities. If there

has been definite loss of substance in a wound from sloughing, the scar will be proportionately thicker, and if over a bone it may be depressed and attached to the bone.

Apart from these general features there are certain special types of scars that are very characteristic, amongst which may be mentioned:—

Burns and Scalds. These are generally large and irregular, often (in burns especially) showing keloid patches or lines. A scald from boiling water can usually be distinguished from a burn by the peculiar stippled appearance it presents, as though the ducts of the various skin glands were still visible on the surface.

Surgical Operations. These are commonly indicated by their linear form and situation, and often suggest the reason for their occurrence—herniotomy, amputation, etc.; the marks of the stitches which held them in position may sometimes also be seen.

Syphilitic Scars are generally thin, often "tissue paper-like"; they are sometimes difficult to distinguish, but they cannot easily be mistaken for the scars of wounds. The elasticity of the skin, the looseness or density of the cellular tissue beneath, and the tension of the muscles are conditions which will modify the form of a sore as well as the scar proceeding from it. An expert can seldom do more than distinguish the scars of ulcers arising from morbid causes from those which have resulted from violence.

Vaccination and Small-pox Scars. The scars left as a result of the application of the pure *vaccine* lymph have an irregular honey-combed appearance with white streaks, and are slightly depressed below the level of the surrounding skin. If the vaccination sore becomes infected with common pyogenic organisms the scar may be like that of any ulcer. The scars produced by *small-pox* are in the form of deep depressions, showing destruction of the cutis, often disfiguring the face.

Punctured Wounds. Stabs, bullets, etc., generally leave small puckered cicatrices, from which it is generally impossible to give evidence as to the nature of the weapon inflicting them. In wounds alleged to have been caused by projectiles the exit wound should be looked for and if none is found an X-ray photograph of the part should be taken.

It is, without other circumstantial evidence, frequently very difficult or impossible to say how the wound of which we have only the scar to examine was inflicted. If the person is living, he may give a description of the injury and the date of its production, consistent or inconsistent with the appearances presented.

it is reasonable to infer that the allegation is untrue, or that the circumstances have been greatly exaggerated.

Taylor's opinion was sought in the following case:

The medical evidence was to the effect that "there was a wound on the nose of the prosecutrix, apparently inflicted by some sharp instrument, and the bridge of the nose was broken. The weapon had entered half an inch, and had caused profuse bleeding. The wound was so deep that if it had entered a little higher up in the eye, it might have caused death". It was assumed by the jury that *a weapon must have been used, and the prisoners were convicted,* the one of stabbing and the other aiding and abetting. About six months after the alleged stabbing, and some weeks after the prisoners had been convicted and sentenced to punishment, the face of the prosecutrix was examined by two surgeons (one of them a practitioner of twenty-eight years' standing), and they both deposed that there was no mark of a cicatrix from a stab, or fracture of the nose, or of any personal injury whatever. In consequence the medical facts of the case were referred to Quain, Guthrie, Key, and Taylor. The evidence of the surgeons at the trial was laid before them, with the statements of the two surgeons who subsequently examined the prosecutrix. They all agreed that if such a wound as that described in the medical evidence had been inflicted, there would have been a visible scar and a ridge of prominence indicative of the situation where the bridge of the nose was stated to have been broken; and as no such marks could be perceived by two well-informed surgeons, they considered it improbable either that such a wound as that described could have been inflicted, or that a weapon could have been used in the assault.

The question of the removal of scars, or rather what can be done to obviate their results, occasionally arises in civil cases where the amount of compensation is to be determined. Thus deformities of the eyelids produced by burns may be occasionally relieved, joints set free, etc., but it is *generally* held by the courts that a claimant cannot be compelled to submit himself to an operation to relieve another party of any part of the latter's responsibility. In a case where an explosion of gas had resulted in severe scars of the face causing ectropion with overflow of tears, the judge ruled that the possibility of relief by a plastic operation was not to influence the jury in awarding damages.

Scars in Evidence. Such being the guiding principles upon which questions regarding scars may be determined, we have now to see how they have been employed in practice. Frauds of this description are rare, for the wound must be made in anticipation in order to give the appearance of an old scar. It *is more likely that an imposter may seek to gain this object by* attributing the scars of wounds, accidentally received, to actionable causes. By a remarkable coincidence two persons may have scars on or about the same part of the body produced by cuts, punctures, or abscesses in early life; and serious mistakes may be made in these circumstances. Taylor recorded the *following miscarriage of justice:*

In 1794 a man named Lesurgues was convicted and executed for murder. There were doubts at the time as to his identity, and strong exertions were made to save his life. Soon after his execution the real murderer was discovered, between whom and Lesurgues, who had had no part in the crime, there existed a resemblance in stature, complexion and features. But the most extraordinary part of the case was that Lesurgues, like the real criminal, had a cicatrix or scar on the forehead, and another on the hand; and there is no doubt that these points of resemblance, which upon a proper scientific examination might have been proved to be really different led to the conviction of an innocent person.

On the other hand, an impostor, with old scars upon his person, may make *use of them as proofs of identity.* Such scars may exist; they may be clearly

proved to be of old date, and they may be assigned to causes which cannot be disproved except by a close medical examination.

At the second Tichborne trial[1] the possibility of the disappearance of scars was made a matter of great importance as bearing upon identity. Roger Tichborne the missing baronet, whilst on board the ship *Pauline*, met with an accident by which a fish-hook passed through one eyelid, and had to be pulled through and out; and it was truly alleged that such a wound would leave a scar, and that this would probably be indelible. He had also been bled, an operation which usually leaves indelible scars. It was also certain that, when a lad, Roger had either an issue or seton on his left arm. According to the prosecution it was an issue, 'and was kept open by a pea. According to the defence it was a seton. On the defendant's arm there was the mark neither of an issue nor of a seton. Moreover, there was no scar on the eyelid such as would have been produced by the fish-hook. Further, Roger had his temporal vein opened when a young man; and there was no scar on the defendant's temples. Although it was admitted that a venesection mark might disappear in the course of time, it is in the highest degree improbable that several cicatrices such as have been described would all disappear. The defendant was convicted of the attempted imposture, or rather of perjury, in swearing at the first (civil) trial that he was the veritable Sir Roger Tichborne.

It may be alleged, in proof of identity, that at a former period of life certain operations had been performed on the body of an individual and it may have to be determined whether such scars as are present have been the result of the alleged operation. If they are not visible at the time of examination the 'question whether they may have faded or disappeared by lapse of time may have to be decided. Such simple questions may carry with them momentous issues, either in a civil or a criminal case; they can be answered by reference to the above paragraphs and cases.

· Beck quotes the case of a child, who had been bled in the right arm when sixteen months old. When nearly four years old the child was lost, and two years subsequently the godmother, seeing two boys pass, was struck with the voice of one of them; she called him to her, and was convinced that it was her lost godson. The identity was also considered to be proved by the discovery of a cicatrix from bleeding in the right arm, and a cicatrix from an abscess in the left knee, both of which were present in the lost child and also in the one that was found. The latter, however, had upon his body marks of small-pox, while no marks of this kind were on the body of the former. The child was claimed by a widow (Labrie), and many witnesses deposed that it was really her son. The court decided in her favour, chiefly on the ground that the lost child was not marked with the small-pox. It was admitted that this child had, on the arm and knee, cicatrices similar to those which were known to exist in the one that was missing. The widow Labrie admitted that her child had never been bled in the arm, while the missing child had certainly undergone this operation; but there was a conflict of medical opinion. Three surgeons examined the cicatrix, and declared that it had been made with a sharp instrument. Others deposed that it was not a cicatrix from bleeding, but from the opening of an abscess. As the child had been missing two years, it might have had small-pox in the meantime.

From the medical evidence, the case seems to have been wrongly decided.

into a white skin is to produce either a blue or bluish-coloured mark. The foreign matter thus introduced mechanically into these minute punctured wounds causes inflammation, but this soon passes off, and the colouring matter then remains permanently entombed in the substance of the cutis, or below it.

Although scars and tattoos, being liable to repetition, do not afford conclusive identification data, they provide further links in the chain of evidence which may by its multiplicity of facts become virtually conclusive. Initials, either personal or of those loved enough at the time—"I. L. . . ." often recording the initials of a girl friend—and dates of campaigns, service badges and lettered tombstone devices are especially useful for identity

The more colourful, lewd or libidinous designs, snakes, butterflies and the like are too common to have much value individually, but may sometimes be so elaborate as to assume more significance.

Apart from their value as a means of identification, tattoos occasionally form the basis for two important medico-legal questions. Can they ever fade away completely? And can they be removed artificially?

Natural Disappearance of Tattoo Marks. The design itself consists of particles of insoluble pigment which have reached, and remained fixed in, the outermost layer of the true skin or in the deepest layer of the epidermis; in the layer, that is, which is never shed bodily, but which keeps on multiplying to provide the more superficial layers. Hence the natural process of disappearance consists in gradual conveyance in solution, convection of particles into the lymphatic channels or convection by cells towards the surface[1]; the efficiency or permanency therefore, depends very materially on the indestructibility and insolubility of the particles of pigment, and on their reaching a situation to which phagocytic cells have ordinarily but little access. Thus it is found that vermilion and ultramarine have the least resisting power against disintegration and solution, while Indian ink and soot or carbon have the greatest; and that the most durable situation is just below the epidermis; in the firmest layer of the true skin. Tidy goes so far as to assert that a design once efficiently inserted and made of carbon never disappears by natural means, and all authorities agree that ten years is the shortest time in which even vermilion or cinnabar tattoo marks can disappear.[2] Some residual pigment may still be found in the regional lymph glands.

It must be admitted that tattoo marks are not necessarily indelible, but they have been observed to remain for 50 years and upwards. The situation of the marks has also something to do with the rapidity of disappearance. Thus they would naturally disappear more easily from a place, such as the hand, where severe friction was of frequent occurrence, than from the chest or upper arms. Shie observed tattoos 64 years old "quite as distinct as when made".

Artificial Removal of Tattoo Marks. The application of caustic and blistering fluids to the part or the galvano cautery may cause the removal of tattoo marks, but the process is almost bound to result in the production of a scar. Only surgical excision and graft can be expected to remove a tattoo completely.

CO_2 "snow", silver tannate or salicylic acid made into a paste with glycerine applied over the marks with a compress have also been suggested. Treatment of this kind must be applied very cautiously.

[1] Mathews, D. N., 1917, Proc. R. Soc. Med., 40, 881.
[2] Shie, M.D., 1928, J. Amer. med. Ass., 90, 94.

On the occasion of the second trial of the claimant of the Tichborne estates the possibility of the effacement of tattoo marks became a prominent question.[1] It was well known that the missing baronet had been tattooed along the whole length of the forearm. The claimant had no tattoo marks, nor any signs of tattooing; but above the left wrist there was a large scar, as if a piece of the skin had been cut or burned out. Ferguson and Holt stated that nothing would remove a tattoo mark short of the knife or a cautery. The man Orton was said to have had the letters "A. O." tattooed on his arm. Evidently a clumsy attempt had been made to obliterate the implicating letters "A. O." on the wrist.

One of the most remarkable cases of identification from a tattoo mark is the so-called Sydney shark Case. A man called James Smith disappeared on April 8th, 1935, and was never seen again. On April 22nd a shark was caught off the beach at Coogee and was sold to the Aquarium—where after three days it vomited up a quantity of material including a human arm. The arm, which belonged to an adult male, was in a fairly good state of preservation, and, according to the medical evidence had been severed from a dead body, not by a shark bite, but by a clumsy incision with a sharp instrument. On the forearm there was a tattooed design of two men boxing.

Several men whose arms were tattooed were missing, and finally the search was narrowed to two men of which James Smith was one. Smith's wife and brother both definitely identified the arm as that of Smith and finger-print experts were able to support the identification. An arrest was made of an associate of Smith, one Patrick Brady, who was tried for murder at the C.C.C., Sydney, in September, 1935. Truly a unique series of coincidences which led to positive identification of the missing man.

SEX

The identification of the sex of any given individual is naturally a very important matter in the ordinary meanings attached to the word identity, and it must be considered here; but as the point has other important bearings in legal medicine, for which there seems to be no more appropriate place of introduction in this work than the present, it will be discussed fully once for all in its practical relationships. The sexing of human remains is dealt with on p. 148.

Sex may require to be established positively in one direction or the other for the following reasons:—

1. For purpose of simple identification in a living or dead person.
2. For purposes of deciding whether an individual can exercise certain civil rights reserved to one sex only.
3. For deciding questions relative to legitimacy, divorce, paternity, and affiliation.

We may consider the evidence that is available for determining sex and discuss its abstract value.

vesiculæ seminales, and penis, which are accessory to the introduction of the sperm. The third category consists in the possession of an ovary by the female and in the possession of a testicle by the male. The problems of both inter-sexuality and of bi-sexuality (or true hermaphroditism) are dealt with below.

Presumptive Evidence. In the ordinary associations of everyday life this is usually, one must admit, accepted as sufficient, but cases in which the sexes change clothes for purposes which range from purely innocent through the mischievous down to the most vilely criminal are very frequent, especially in the haunts of homosexuality and prostitution. The detection of such cases as a rule requires nothing but the ordinary knowledge of the detective or female searcher.

In some cases the condition of the voice and the hair give rise to certain doubts: in old women it is not unusual to see a growth of hair on the chin and lips. It would not be safe to rely upon this as evidence of the male sex at any time of life, for endocrine imbalance is common indeed.

M. C., æt. 42, was admitted into the Norfolk County Mental Hospital suffering from mania. She had a vigorous growth of hair on the lips and chin, for which depilatories had been used, but these made matters worse. The upper part of the body was masculine in form, and the breasts were undeveloped, as in the male sex. The lower part of the body was feminine in outline, and the voice had the feminine tone and character. The clitoris was largely developed, having a distinct prepuce. There were no testicles in the labia or in the inguinal canals. There was a distinct vagina, and the finger appeared to touch an os uteri. At an early age she had had the slightest possible signs of menstruation on three consecutive occasions. In her girlhood she would not associate with other children. While in the hospital she evinced strong sexual passions, and behaved indecently to the nurses. She had a thick moustache and a full beard.

Such abnormalities of sex differentiation are not infrequent and have in recent years become better understood.

A remarkable case, in which a female had successfully personated a male for many years, occurred in 1865. The case was that of *Dr. James Barry*, who was well known as Staff Assistant Surgeon and Inspector of Hospitals. He died in 1865, at the age of eighty, and although suspicions had existed among those who had personally known him that he laboured under some sexual defect, it was only proved after his death that he was really a woman. When, where, and how he passed through his medical studies no one knew, but he contrived to obtain a diploma as Doctor of Medicine from Edinburgh when only fifteen years of age. The young physician entered the army, and served much abroad. In due course he retired from the service, received a pension, and was made Inspector of Hospitals. In 1857-8 and subsequently his appearance and manners were effeminate. His face and hands were smooth and white, like those of a woman; he had no beard or whiskers. He was thin, and in stature resembled a woman, his limbs being small, but in good proportion. His voice was shrill and squeaking, quite unlike that of a man. The impression left upon the mind of all those who saw him was that he laboured under some sexual malformation. After his death, however, it was found that he had the sexual organs of a woman. He had specially desired that no *post-mortem* examination of his body should be made, but this order was disobeyed, a special report having been ordered by the authorities. It is difficult to comprehend how, in assuming the attributes and duties of an army medical officer, he could have so successfully maintained the deception through a long life. Whether he menstruated or not does not appear. He is said to have always worn a peculiar and tight-fitting dress.

What used to be regarded as *"Highly Probable"* and *"Certain"* evidence of sex is now better understood to range from well defined sex on the one hand to frank *bi-sexuality* (or *true hermaphroditism*) on the other—with a

considerable range of *inter-sexuality* between the two. The orderly arrangement of these depends upon an understanding of the development of the sex organs, to which, therefore we must devote some attention.

The following table gives the scheme of development of the sex organs in condensed form:—

INTERNAL PARTS
Mass of Germ Epithelium[1]

Diagram Reference No.	Female	Male
1.	Ovary	Bulk of testicles

Mullerian Ducts (Ducts of Pronephros)

2.	Fallopian tubes.	Hydatid of Morgagni.
3.	Hydatid.	Uterus masculinus in prostatic
4.	Uterus and vagina.	urethra.

Wolffian Bodies (Mesonephron)

5.	Parovarium.	Vasa efferentia (coni vasculosi).
6.	Paroophoron.	Organ of Giraldés, vasa aberrantia.
7.	Round ligament.	Gubernaculum testis.

Wolffian Ducts

8.	Chief tube of parovarium.	Convoluted tube of epididymis.
9.	Ducts of Gartner.	Vas deferens and vesiculæ seminales.

Metanephron

	Kidney and ureter.	Kidney and ureter.

EXTERNAL PARTS
Genital Eminence

10.	Clitoris.	Penis.

Cutaneous Folds

11.	Labia majora.	Scrotum.

Cloaca

12.	Rectum	Rectum.
13.	Vagina.	Connective tissue.
14.	Urethra.	Urethra.

The table may be explained as follows:—At a very early period in fœtal development there is found a single mass of cells at the back of the abdomen. This soon divides into two, one on each side of what will afterwards become the bodies of the vertebræ. From each of these masses is developed a series of glands and ducts, of which the glandular parts remain separate in the form of two testicles or ovaries, and two kidneys; the ducts at their upper ends also remain separate as ureters in both sexes, and as the Fallopian tubes in females. The parts in the male corresponding to Fallopian tubes in the females remain as fœtal remnants; the lower ends of the two ducts unite and

form in the female the uterus, and in the male a small fœtal remnant. None of these changes in the internal parts, or rather in the parts inaccessible without an operation, is of much interest to the medical jurist with one important exception, and that is the changes of position in the testicles. These should normally lie at the sixth month intra-uterine life on the psoas muscle, at the seventh month near the internal inguinal ring (in the mid-groin abdomen wall), at the eighth month in the inguinal canal, and at the ninth month in the scrotum. If these changes of position do not occur the condition known as retained testicle (cryptorchism) is present. In the female an ovary occasionally appears in the labium majus, thus producing an approach to the male conformation.

The external parts, and those accessible to inspection without operation, are of the greatest interest to the medical jurist in the determination of sex. In the early days of development there appears at the lowest part of the abdomen the genital eminence, which consists of a central prominence with two diverging wings, one on either side, with a wide aperture between these wings. In its very earliest state this aperture is really a common cloaca, into which open both urinary and fæcal outlets. By an ingrowth of tissue the rectum or fæcal outlet is soon separated off, and its anomalies are of interest only to the surgeon. In the anterior division (the urogenital orifice), the changes in the two sexes proceed on very different lines. In the male the two diverging wings of the genital eminence unite in the middle line and form the scrotum into which the testicles descend, while from the angle between them grows the penis, with its corpora cavernosa and the corpus spongiosum, enclosing the urethra. In the female the two diverging wings remain separate, leaving a space between them which constitutes the vulva, the vagina being formed out of the middle portion of the original cloaca. The urethra, as in the male, is a small anterior portion separated from the vagina by an ingrowth of connective tissue. From the angle between these diverging wings the clitoris develops in the same way as the male penis, but it does not enclose the urethra, the opening of which is situated in the middle line below the clitoris.

It will thus be seen how easily mistakes may occur in naming the sex of a new-born infant. The penis has only to be very small to be precisely like a clitoris, and the clitoris large to be like a penis; the labia majora have only to unite to present the appearance of a scrotum, and the halves of the scrotum to remain separated to have the appearance of labia majora; and these anomalies have only to be present with internal organs that do not correspond to produce a bewildering variety of intersexuality or frank bi-sexuality (hermaphroditism).

INTERSEXUALITY

The classification of doubtful sex cases is probably best based on the histology of the gonads. Intersex cases show numerous minor variations of the principal anomalies of development which are:—

Intersex Females (female pseudohermaphrodites)

With hyperplasia of the adrenal cortex. These are probably due to a swing over of virilizing influence from the adrenal cortex at about the 12th week, resulting in a deflection of development. The ovaries and Müllerian ducts first develop more or less normally, forming the uterus and Fallopian tubes, but after the 12th week the virilizing hormones become more active, the
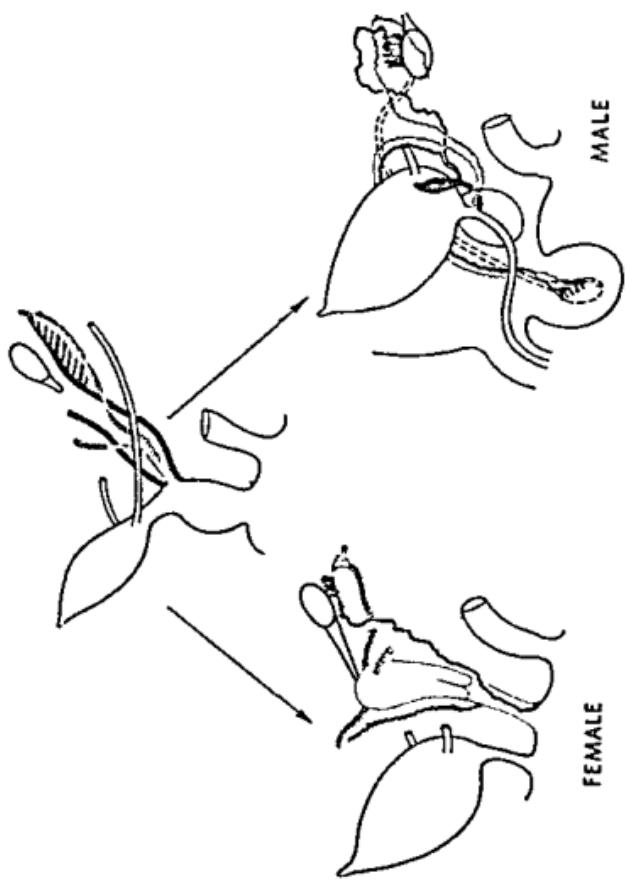
FEMALE

MALE

Fig. 11. Diagram showing development of male and female sex organs from a common type (*above*) at about the beginning of the third month (after Allen Thompson). Pronephron (Müllerian) duct system in blue. Mesonephric (Wolffian) ducts in red. The double interrupted line in the male diagram shows the descent of the testis. (See p. 111 for details).

True Hermaphrodites, possessing both testicular and ovarian tissues have been frequently reported[1]. A penile urethra (without verumontanum) vagina, uterus and tubes and ovo-testes may be found. The body development tends on the whole to be effeminate.

Laycock and Davies (1953)[2] describe a girl of 17 with normal female instincts and general development but with similar genitalia to those described by O'Farrell (vide supra) except that the right labium majus contained a small fully descended mobile "testis". Microscopy of this showed about two-thirds to be well differentiated testicular tissue and a polar third to be ovarian: there was no spermatogenesis in the testicular portion but normal Graafian follicles lay in the ovarian part.

No known case of this kind has achieved parenthood though both spermatogenesis and folliculation are common. The male cases require repair of the hypospadias and hysterectomy; the females amputation of the phallus and often a plastic vaginal operation. Early removal of the unwanted gonad is the best way of avoiding secondary sex difficulties, but reverses, changes of feeling and social upheavals that may perplex are likely to occur in untreated cases.

In 1952 a north country doctor, who had been registered as a female and had been in practice as a woman doctor for some years, registered a change of sex and announced his engagement to a woman acquaintance.

To determine the Sex of a given intersexual, a very thorough examination is necessary both of the external genitalia and of the internal structures together with microscopy of the gonad.

The above facts of development constitute the principles which guide one in a decision. On the one hand, in a male person the lack of union of the cutaneous folds (hypospadias) and the lack of growth of the genital eminence (the penis), on the other hand, in a female person the excess of union of *the folds* and the excess of growth of the clitoris, constitute a guide to assessing inter-sexuality.

If the local examination leaves one still in doubt, the other sexual characteristics must have the greater weight attached to them, such as the distribution of the hair in general, the development of the breasts, the sexual instinct of the individual, menstruation, etc., etc., though that intersex is variable is proved by well-authenticated cases of individuals having to change their apparent sex as a result of a medical examination even as late as 20 or 25 years of age, and that, too, after sexual connection of an inverted character has long been indulged in (vide supra).

D. F. J. Smith[3] quoted a typical example of the difficulty in determining sex in the living until operation.

"A Case of Spurious Hermaphroditism (Hypospadias and Undescended Testes in a Subject who had been brought up as a Female and been married for Sixteen Years).[4]

"A woman, forty-two years of age, was recently admitted on account of a painful swelling in the left groin. She stated that a fortnight previously she was lifting some heavy furniture when something seemed to give way in her stomach; she felt very sick and had an acute pain in her left groin; on feeling the groin she found a tender swelling there; when she lay down it got smaller, but on her again rising the swelling regained its former size. The severe pain did not last long, and she was able to follow her occupation, but she was always in more or less pain and discomfort, and the swelling seemed to be slowly enlarging, so at the

    [1] Bromwich, A. F., 1955. Brit. med. J., 1, 395.
    [2] Laycock, H. T., and Davies, D. V., 1953. Brit. J. Surg., 41, 79.
    [3] Editor of this textbook, 1905-1920.
    [4] Lancet, 1898, 1, 719.

end of a fortnight she deemed it advisable to seek medical advice and went to the hospital. The notes state that on admission she was of somewhat masculine appearance, the breasts were well developed, but the nipples were rudimentary, and the areolæ were not marked. There was no hair on the face, and there was but little on the pubes. An ovoid solid body feeling just like a testicle rather above the usual size occupied the left inguinal canal. A similar but smaller swelling was observed in the right groin; this was not tender, and the patient was not aware of its existence until her attention was called to it. The external genitals were normal in appearance, and the vagina was of normal calibre and length, but the finger introduced into the canal demonstrated a *cul de sac*. No os or cervix uteri could be felt, and a bimanual examination failed to detect the presence of a uterus. The patient had been married for sixteen years, and her husband had died within the last year; she had never been pregnant, and neither she nor her husband had any idea that she was in any way different from other women. She began to menstruate at the age of twelve years, at first not very regularly, but from fifteen to thirty-eight years of age she never missed the catamenial flow every four weeks, and it always continued for twenty-four hours, and no longer; in the interval she had a constant white discharge. An incision was made over the left swelling, the sac was opened, and what were to all appearances an ordinary testicle and spermatic cord were drawn out of the wound. Microscopy was not done. If microscopy had been performed, it might well have revealed the 'ordinary testicle' to contain both ovarian and testicular tissues.

A large number of similar cases are reported both in textbooks on endocrinology[1] and in many medical journals (*vide supra*). They show how difficult questions of sex may be when required to be answered in connexion with civil rights and duties in cases where the person whose sex is to be determined is alive and will not submit to an operation.

A diverting case occurred in America and was described by Taylor as follows:—

At an exciting and warmly contested election in the United States of America in 1843 almost everything bearing the semblance of the human form of the male sex is stated to have been brought to the ballot-box. It was at this time, and under these circumstances, that Levi Suydam, aged twenty-three years, a native of Salisbury, Con., was presented by the Whigs to be made a *freeman*; he was challenged by the opposite party, on the ground that he was more a female than a male, and that in his physical organization he partook of both sexes. There was a mons veneris, covered with hair in the usual way; an imperforate penis, subject to erections, about two and a half inches in length, with corresponding dimensions; the dorsum of the penis was connected by the cuticle and cellular membrane to the pubis, leaving about an inch and a half free, or not bound up, and towards the pubic region. This penis had a well-formed glans, a depression in the usual place of the outlet for urine, with a well-defined prepuce. The scrotum was not fully developed, inasmuch as it was but half the usual size, and not pendulous. In the scrotum, and on the right side of the penis, there was one testicle, of the size of a common filbert, with a spermatic cord attached. In the perineum, at the root of the corpora cavernosa, an opening existed through which micturition was performed; this opening was large enough to admit the introduction of an ordinary-sized catheter. Having found a penis and one testicle, although imperfectly developed, Barry, without further examination, gave it as his opinion that the person in question was a *male citizen*, and consequently entitled to vote and enjoy all the privileges of a *freeman*. On the morning of the election day Ticknor objected to him as a *female*, and therefore not entitled to vote. Barry then stated to the meeting that, from an examination he had made, he considered the person in question to be male; and requested that Ticknor might, with the consent of Suydam, retire into an adjoining room, and examine him for himself. This was done, when Ticknor ultimately came to the conclusion that this person was really a male. He was accordingly admitted a *freeman*, and his vote was received and registered.

[1] Wilkins, L., 1950. Diagnosis and Treatment of Endocrine Conditions in Childhood and Adolescence. Springfield, Thomas; also Young, H. H., 1937. Genital Abnormalities Hermaphroditism and Related Adrenal Diseases. Baltimore: Williams & Wilkins.

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A few days after the election Barry heard that Suydam had regularly menstruated as a woman. His sister informed Barry that she had washed for Suydam for years, and that he menstruated as regularly, but not as profusely, as most women. When questioned, he very unwillingly confessed that such was the fact. He was again examined by the two physicians, when the following additional particulars were elicited:—Suydam was five feet two inches in height, light-coloured hair, fair complexion, with a beardless chin and decidedly a sanguineous temperament, narrow shoulders, and broad hips—in short, every way of a feminine figure. There were well-developed breasts, with nipples and areolæ. On passing a female catheter into the opening[1] through which micturition was performed, and through which he stated he had a periodical bloody discharge monthly, instead of traversing a canal and drawing off urine, the catheter appeared to enter immediately a passage similar to the vagina, three or four inches in depth, and in which there was a considerable play of the instrument. He stated that he had amorous desires, and that at this time his inclination was for the male sex. His feminine propensities, such as a fondness for gay colours, for pieces of calico, comparing and placing them together, an aversion for bodily labour, and an inability to perform the same, had been remarked by many.[2]

Sex in Matrimonial Suits, Legitimacy, Paternity, and Affiliation.

In such cases as these the question of the determination of a definite sex is of comparatively little importance compared with the questions, is this person physically incapable of procreation, whether as a father or mother? Is the malformation such as to justify a suit for nullity of marriage on the ground that the person is incapable of proper sexual intercourse? Could this person possibly be the father or mother of this child? These questions are dealt with fully in Vol. II.

Such cases seldom come before the British courts, and are still more seldom reported with any details; the individuals in question would almost without exception be both impotent and sterile, and yet there is no reason why any of them who survives infancy should not live to a marriageable age, and even go through the ceremony of marriage in ignorance of the real state of affairs.

When these beings have reached adult age, other questions may arise in regard to them. The English law does not allow them to select their sex, but determines it for them by medical evidence. Hermaphrodites, were formerly classified with infamous persons; and it has been a grave question in the English courts whether describing a man as a hermaphrodite was not such a libel or slander as to render it a ground for a civil action. In a case reported by Chitty, the use of this term was held not to be actionable, unless it was proved that it had been attended with special damage. A dancing master brought an action against a person for calling him a hermaphrodite, and it was decided that it was not sustainable—(i) because it was asserted that such a union of the sexes cannot exist in fact, and everybody must be supposed to know it; consequently the assertion could not be supposed to prejudice; (ii) because, admitting the possibility of such a double function, the party would be just as good, and perhaps even a safer, dancing master than if only one perfect sex had been discoverable: consequently the words would not, in legal presumption, injure him in his profession or occupation.

Re-registration of Cases of Sex Error.

In any case in which an error has been made about the sex of a child the parents or guardians should not neglect to re-register the birth of the child. The following procedure is to be followed in re-registering a child:—

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[1] This was, no doubt, a persistent urogenital orifice.
[2] *Amer. J. med. Sci.*, 1847, **14**, 123.

"Application for the re-registration of the birth should be made to the Registrar-General accompanied by the particulars of the case by the medical practitioner who has examined the child. If this is satisfactory the Registrar would be instructed to re-register the birth on the information of one of the parents or other informant qualified under the Births and Deaths Registration Acts. Should there be no qualified informant available, then the original entry would be corrected on the authority of a statutory declaration, made by two persons cognisant of the facts, one of whom would be the medical practitioner."

HAIR

The value of the hair as a feature of identity is considerable under ordinary circumstances, though it can be artificially altered by dyeing or bleaching: but many medico-legal questions may arise concerning it, and the subject may be dealt with here in all its aspects to avoid repetition. One of its outstanding contributions to crime detection is the link it provides between victims of assault and either weapons found elsewhere or the person of suspects . . . the latter commonly in sexual assaults.

Hair as a Factor in Identification

This is a matter principally of colour, character, length and distribution.

Colour in its natural state offers but little means of positive identification beyond the fact that the hair on the dead body is of the same colour as that of the missing person. The different shades of colour are indeed very numerous, but they are nothing compared with the number of individuals in the world. It may, of course, happen that there may be something peculiarly striking in the colour of the hair of a corpse either in general or in some part of it, such as a lock of white hair in the midst of a head of dark hair which in a limited population might become of corroborative importance if the age and other points of identification conformed to those of the individual known to be missing.

The colour may be artificially altered, and medical jurist must be acquainted with the commoner means employed for such purposes, and how they may be detected. The means employed are of two broad classes (a) substances applied to the hair which by their presence *conceal* the colour; (b) substances which *alter or destroy* the colour such as henna or bleaching agents. Amongst the former, lampblack to obtain a black colour, and flour, chalk, etc., mixed with some greasy substance to obtain a white colour may be used, but are easily detected by washing the hair or brushing it in water. The latter are a little more difficult to detect, but the fact of dye having been used is usually suggested by one or two simple observations. Thus (a) it will commonly have been applied to the hair of the head only, the pubic and other hair having been left untouched. (b) If it has not been applied recently the bases of the hairs will show a short length of the natural colour by growth since the application. (c) The microscope will generally show that the dye has left small spots and patches untouched, the trunk of the hair showing different colours[1]. (d) The skin of the scalp or face may also show contamination from the dye. Bleaching substances, such as chlorine and peroxide of hydrogen, used to produce flaxen locks, have a tendency to make the hair brittle, and hence may be suggested by the frayed condition. Organic dyes such as the paraphenylene diamines are mostly used for dyeing the hair black or brown. Lead and bismuth are occasionally used for dyeing purposes. If

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[1] Both ultra-violet and infra-red light are useful adjuncts to this procedure and to photography of hair. Ref. Kirk, P., 1953. *Crime Investigation.* Interscience Publ. Inc., New York.

they are suspected, the hair may be digested with strong nitric or nitrohydrochloric acid, and the resultant liquid tested for these metals. It is not difficult as a rule to decide whether the hair has or has not been dyed.

Character. There are many characters of hair which may serve as corroborative points in identity either of a person or of a given individual hair, but they are mainly those denoting the race from which the person came. The curly short spiral hair of the Negro or Hottentot, for instance, is well differentiated from the hair of any European race; the straight lank hair of Mongolians and most aborigines is much coarser than hair of similar straightness occurring in more civilized races. Information derived from mere similarity of the way in which whiskers, beard, and moustache are worn is of very little value without strong corroborative evidence.

Length. This gives nothing more than a suggestion in a case of an unknown person. A man may let his hair grow, and at the present time a great many women wear their hair short. It may be of some little importance to determine whether the hair in question has its natural length, or whether it has been artificially shortened by cutting; the microscope will easily detect the difference. If of natural length it *may* be possible to suggest its origin—eyebrow, scalp, pubes, etc, by its shape or by transverse section. (See p. 122.)

Distribution. The distribution of the hair may be of a certain importance in identification. For example, a quantity of hair in the beard region, hair in the ears, nose and anus, profuse hairiness of the torso, are all suggestive of the male. The distribution of pubic hair differs in the two sexes, in the male the hair tends to run in a triangular manner towards the umbilicus, in the female it usually terminates along a line joining the iliac spines. In suprarenal virilism in females hair may be found growing profusely in masculine sites.

Can the Hair Grow after Death? It may be accepted as a fact that growth of the hair after death does not take place. The skin shrinks after death, and hence a man who has been shaved just previous to death might in 24 hours appear not to have been shaved. Scorching of the skin may cause the same appearance.

Hair as a Factor in Criminal Evidence

In this connection hair may assume a position of outstanding importance. The questions that a medical witness must be prepared to try to answer are—(1) Is the object submitted for examination hair or some other substance? (2) If hair, is it human or from some other animal? (3) If human, from what part of the body did it come? (4) Is it the hair of a certain person?

1. Is this Hair or something else? In examining any blood clot or small mass of mud from boots or articles of like nature, the substance must be macerated in saline to affect the separation of any fibres from the mass. If a boot or any weapon is submitted for examination, it must be scrutinized closely by the naked eye and with a lens, especially in any of the unevennesses in general contour, such as the junction of shaft and blade, notches on the blade, cracks in boot nails, junction of nail with leather, hooks or lace holes, etc., etc. Any fibres must be carefully extracted by forceps after maceration and submitted to microscope. A precise and detailed examination of the cuticular scale pattern, the cortex and medulla must be made of the whole length of the hair, and of both extremities. It may also be necessary to make

a cross section of the shaft. If only one hair is available it must be kept in its natural state for comparison with other hairs should this be required at a later period.

The substance of a hair is mainly composed of a pigmented horny fibrous material known as the cortex which can be separated by the action of sulphuric acid into long tapering fibrillated cells, the nuclei of which may still be visible. Most of the pigment of the hair is found in this layer. This fibrous substance of the hair is covered by a layer of delicate imbricated scales termed the hair cuticle, the form of which is of great value in identification. In many hairs, but not in all, even in the same person the centre is occupied by a medulla which may present features of a certain value in identification from its size, relation to the cortex and the shape and size of its cells. There is little pigment in the medulla but the presence of air gives the appearance of colour. The root has the same structure as the body of the hair except at its extremity, which is enlarged into a knob composed mainly of soft growing cells, fitting over a vascular papilla which projects upwards from the bottom of the follicle.

The substances which are likely, to the naked eye, to be mistaken for hairs are fibres of the common stuffs for clothing—cotton, hemp, silk, nylon and wool. Cotton presents itself under the microscope as a flattened band, assuming more or less a spiral form. The fibre of linen derived from flax is of a rectilinear form, with jointed markings at unequal distances, the fibre tapering to a point. Silk being the dried secretion of a gland presents a regular cylindrical form, and there are no markings upon the surface. It has a strong refracting power on light, which gives to the fibre a well-defined boundary. The fibre of wool is irregular, contorted, of unequal thickness, and it has peculiar markings of an imbricated character on the surface. The microscopical characters of these fibres under certain cirumstances are long retained, so that they may be identified after many centuries.

The woollen fibre from the shroud of a monk buried in an ancient priory in the fourteenth century, and exhumed after the lapse of five hundred years, showed markings little less defined than in a recent sample of wool; the fibres were of a coarser and larger kind.

The fibre of linen appears to be equally indestructible. Fibres from the linen cerements of a mummy, of the dynasty of the Shepherd Kings, unrolled in 1832, were well preserved and still tough. The ancient wool was rotten, and broke into small fragments. The linen had the characters of the fibre of modern flax. It was of a very coarse fabric, and was strongly impregnated with a brown bituminous matter used in embalming. Its preservation was no doubt in great part owing to the presence of this substance.

Other fibres are frequently found upon weapons, boots, and articles of dress. These commonly prove to be vegetable fibres from roots, leaves and other substances. They cannot be confounded either with hair or with the fibres described above, but any fibre of whatever nature found in connection with a crime may be of some importance for comparison with other fibres and should be the subject of careful and detailed examination.

If it is Hair, is it Human Hair? The hairs of animals are frequently found on weapons and clothing: they must not be confounded with human hair. They are, generally speaking, coarser and thicker and have a wider medulla than those of a human being, but it is extremely dangerous to give an opinion about the nature of a hair without a careful microscopic examination and after comparison with other known samples of hair.

A decision about the nature of the hair can be arrived at only after a

detailed examination of the cuticular scale pattern, its cortex and medulla, its form and size, and the relative size of its component parts as seen in longitudinal plane and cross section. Infra red photography may assist in establishing these features.

The cuticular scales vary in shape and size in different species of animals, and are of considerable value in identification. They vary considerably however, in different parts of the same hair and may differ considerably in the wool and coat hair of the same animal

These scales may be readily observed on examination in the dry state under oblique light providing the hair is not too deeply pigmented. *A convenient* method of studying the scale pattern is by means of a cast. A thin film of cellulose acetate conveniently purchased as nail varnish is made on a microscope slide in the manner in which a blood film is made. The hair, previously cleaned by immersion in a mixture of alcohol and ether, is placed on the wet film and allowed to remain for about ten minutes. The hair is then stripped from the film leaving an excellent impression of the scale structure which is best viewed by oblique light. The hair is unharmed by this procedure.

The major types of scales may be classified into seven groups shown in Fig. 15, of which type seven is typically human; the presence of this type of hair scale, however, does not enable us to assign the hair to a human origin but the presence of any type other than this definitely excludes a human origin, except in the case of newly-born infants in which type six is often found.

In the examination of the cortex and medulla, the hair if pigmented must be bleached and Davidson and Taylor[1] consider that a great deal of the apparent colour is due to air in the medulla which can be removed by exposure in a vacuum oven.

In general the cortical layer in human hair is relatively broad and the medulla relatively narrow. It is in general narrower than in other animal hairs.

The medulla may be continuous, interrupted or apparently absent altogether.

The cortex is striated longitudinally and such pigment as there is is found in this layer towards the cuticular surface and is best seen in cross section.[2] Davidson suggests the following staining technique for the examination of all three parts of a hair.

(1) Cut root and tip of hair.

(2) Place hair in equal parts of absolute alcohol and ether (cleansing and fat-solvent reagents).   15 min.

(3) Wash well in distilled water.

(4) Place in distilled water in vacuum embedding oven and exhaust at room temperature, maintaining a pressure of 18–30 mm. mercury   2 hr.

(5) Bleach in the following solution:
90 vol. hydrogen peroxide diluted 1 in 3 with distilled water   50 ml.
5 per cent aqueous ferric chloride 1 drop
Excess of liq. ammonia added immediately before use   15 min.–12 hr.

[1] *J. Quekett micr. Cl.*, 1943, **1**, 289.
[2] For details of examination of hairs see Smith, S., and Glaister, J., 1938. "Recent Advances in Forensic Medicine". London, Churchill.

(6) Wash well in distilled water.

(7) Stain in 1:100 carbol fuchsin (Ziehl Neelsen) in distilled water in vacuum embedding oven at room temperature and at pressure of 18–30 mm. of mercury   at least 15 min.

(8) Wash in distilled water.

(9) Decolorize and dehydrate in absolute alcohol   5–10 min.

(10) Clear in benzene and mount in Canada balsam.

FIG. 12. Major cuticular scale types of Mammalian Hair. Magnified 200 diameters. (Moritz.)

Roman numbers refer to scale types.

A hair so prepared gives three optical sections on examination, viz.: (a) cuticular scales on upper surface of hair, (b) cuticle, cortex and cellular structure of the medulla, (c) cuticular scales on under-surface of hair.

Therefore in one preparation the cuticular scales in detail and the longitudinal section of the hair can be studied.

The above examination may enable the observer to diagnose the origin of a hair, or at least the group of animals from which a hair has been derived, but it is never possible to state that a hair belongs to a particular individual or animal. No one is entitled to say more than that the hair appears to be identical in all aspects with the hair from a particular source.

If Human, from what Part of the Body did it come?

Comparison with hairs of known situation is essential. It is of no use whatever to state that the hair of the eyebrow and eyelash is stouter than that of the head, nor that the hair of the pubes and axillæ is stouter than that on the rest of the body. Stoutness is entirely a matter of comparison.

In examining hairs microscopically it will be well to observe whether they are of the same or of different colours or sizes, whether they are pointed at one end or cut at both ends, and whether they have still attached to them the bulb or sheath in which they grew. This condition of the hair will be found when it has been violently torn from the skin. Hairs which have not been cut are pointed at their free extremity unless they are taken from a locality where there is constant friction, such as the axilla or pubis, in which case they frequently show a brush-like appearance. The microscope will sometimes enable a medical jurist to state whether a hair has been indented, cut, or bruised, at either or both ends; the medullary structure frequently retains these marks of violent treatment. A spermatozoon or other body might possibly be found adhering to a hair. All these matters may help in deciding where a hair came from; the site of a blow might, for instance, be known, and a hair on a blunt weapon when compared with another from the same seat of injury may show similarity or not. But without such points of comparison it would be foolish to swear to the locality from which a hair came.

The following cases illustrate the above matters:

In *R. v. Crippen* some hairs found on a hair curler associated with the mutilated remains were shown to be partially bleached; and corresponded with the bleached hair of the alleged victim Belle Elmore.

In *R. v. May* (Reading Assizes, 1926) it was shown that hairs on the coat of the accused were similar in character to the hairs of Shorthorn cattle from the herd from which animals were maimed.

In the Godalming (Wigwam girl) murder (Kingston Assizes, 1943) a birch stake found 400 yards away from the body—which had been buried on a heath—was produced in evidence. It matched a heavy blunt injury on the back of the head, and nine head hairs identical with a sample taken at autopsy from the victim were found clinging to the crushed bark near one end.

In *R. v. Heath* (C.C.C., 1946) a woollen scarf suspected to have been used to gag the victim of a sadistic sexual assault in Notting Hill Gate, was found to be stained with group A1 blood, with nasal slime and with moistened head hairs identical with the sample taken from the dead woman.

In *H.M. Advocate v. Donald* (High Court of Justiciary, Edinburgh, 1934), the sack in which the body of a girl aged 8 years was found was examined for traces of dust, hair and fibres. A few hairs, artificially waved were found to be identical with hairs taken from accused's hair brush, and, in a quantity of fluff, there were found fibres of wool, cotton, linen, silk and jute dyed in six different shades, undyed wool and cotton, fragments of cat and rabbit hair and bits of human hair affording an extensive basis for comparison with sample fluff from the Donald house. No less than 25

different fibres were matched: similar fluff or debris from neighbouring houses afforded no such comparison.

In *R. v. Podmore* (Winchester Assizes, 1931) the victim was found murdered in a Southampton garage and a discarded hammer stained with blood provided a number of eyebrow hairs. Two of these were identical with samples taken from the dead man.

In *R. v. Leckey* (C.C.C., 1943) an auburn haired cinema usherette was found strangled in a Folkestone shop passage. Five black pubic hairs were found adherent to the vulva and adjacent inner thighs of the dead girl and these proved to be identical with sample hairs from the accused who had been arrested in London on suspicion. They afforded a strong link in the evidence which resulted in a conviction for murder. An appeal on a point of law which followed was successful.

In *R. v. Watson and Wife* the prisoners were charged with the murder of a man named Raynor. He was seen going into the prisoners' house and about two hours afterwards his dead body was found lying across a line of railway below it. The medical evidence showed that death had been caused by manual strangulation. No hat could be found. There were marks of dragging between the cottage and the line of railway, and at one part in the soft clay there were the impressions of footmarks corresponding to the boots of the male prisoner. On searching the house an iron rake was found concealed on a shelf, with a cindery substance consisting of burnt shellac and some fibres, which under the microscope proved to be the hair of some rodent animal, adherent to it.

A hat similar to that worn by the deceased, and purchased at the same shop, was burnt. The cindery ash was collected, and submitted to examination. These hats are made of felt, chiefly from rabbits' and hares' fur and this is mixed with shellac; the ash was identical with that on the rake.

AGE

The establishment of the age of an individual has so many medico-legal bearings that it must be fully discussed, after which we may consider the questions that may arise. Inasmuch as even the age of the earliest embryo may have a bearing on the chastity of a woman, it is necessary to commence at the time at which an embryo can be distinguished, although the early products of conception have more connection with evidences of pregnancy and abortion than with identity.

It is convenient to discuss the evidences of age in periods:

1. The age of an embryo up to seven months (the threshold of viability).
2. The age of a fœtus between seven months' intra-uterine life and full term.
3. The age of a child recently born.
4. The age of a child which has survived birth more than a day or two, or of an adult.

limbs are more manifest, the hand has a human appearance. Points of ossification have appeared in the lower jaw and clavicle. The mouth and nose are manifest. The Wolffian bodies have atrophied, and the kidneys have appeared.

"*Third Month.* At the end of the third month the ovum is about four inches long, the placenta is formed, and the rest of the chorion has to a marked extent lost its villosity. The cord has now become long relatively to the foetus, and already shows its spiral twist. The foetus is four to four and a half inches long, and weighs about 450 grains. The head is separated from the body by the neck, and the oral from the nasal cavity by the palate, and the mouth is closed by the lips. The sexual organs have appeared, *but the penis and clitoris are scarcely distinguishable.* The limbs are developed, including the fingers and toes, and a first appearance of formation of nails can be detected. Points of ossification have appeared in most of the bones.

"*Fourth Month.* At the end of the fourth month the foetus is, on an average about six inches long, and weighs about three ounces. The sex can now be distinctly recognized. The bones of the skull have partly ossified, but still have very wide fontanelles and sutures. There is a slight commencement of the formation of down on the skin. Movements of the limbs have commenced; but these may, however, be detected in a freshly expelled embryo even before the end of the third month. *X-ray of the mother's abdomen may now reveal the foetus.*

"*Fifth Month.* The foetus is, on an average, nine to ten inches long, and weighs nearly eleven ounces. Hair has appeared upon the head, and lanugo or down over the whole body. The skin begins to be covered with vernix caseosa. There is a centre of ossification in the calcaneum.

"*Sixth Month.* The foetus is, on an average, about twelve inches long, and weighs about 24 ounces. The eyebrows and eyelashes are beginning to form. Subcutaneous fat is commencing to be deposited, but only in small degree, so that the skin is still wrinkled. There is a yellowish material in the small intestine, and there may be a commencing appearance of the darker meconium in the large intestine. The hair on the head is longer and less like down." A centre of ossification appears in the manubrium sterni.

Seventh Month. The foetus is about 14 inches long and weighs some two and a half to three pounds. The eyelids are opening and the pupillary membrane undergoing atrophy. The skin is reddish and loose, but the hair thickening and darkening. Ossification centres are present in the talus and (three) in the upper two-thirds of the sternum—appearing successively from above down. The testis is descending within the abdomen and may have reached the inguinal ring.

For further particulars the reader is referred to special works on embryology.[1] The term "ovum" signifies the embryo *and* its membranous coverings; the "embryo" is the body which is afterwards converted into the foetus; "foetus" is the name applied to the embryo after the third month of gestation.

One great difficulty consists in determining the nature of the supposed ovum or embryo in aborted matter in the first two months. In making the examination the material should be placed in a dish of water, and all coagula gently washed away or removed by some blunt instrument. If the embryo cannot be found, the decidua and chorion, or portions of them, may be recognized, the former by its forming the outer investment, with its smooth internal and rough external or uterine surface, the latter by its villous or shaggy appearance. Between the third and fourth months the foetus may be commonly identified without much difficulty. The ovum in many instances escapes first, leaving the decidua behind. When a semi-decomposed or dried mass of blood clot, etc., is presented for examination, *it is often convenient to take an X-ray plate of the specimen.* If the foetus is about the third month onwards the ossified ribs and limb bones will be seen. It is important to remember that, in some states of the virgin, decidua-like structures are shed from the uterine mucous membrane which, when examined by the microscope, are like the true decidua. Both are constituted of the innermost portion of

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[1] See Gray's Anatomy. 31st Ed., 1952. London. Longmans Green.

the uterine mucous membrane, and contain all its elements. *It requires a skilled microscopist to distinguish placental tissue with certainty.* Evidence of this nature formed the basis of the libel action *Kitson v. Playfair*, in which Dr. Playfair threw doubts on the chastity of the plaintiff.

Such are the principal points we have for determining the age of the contents of the uterus in the early stages of pregnancy.

The points themselves are of such a nature that, while it is easy to give approximate estimations, it is quite impossible to draw hard and fast lines between say the second and third months and between the third and fourth; and these are precisely the cases in which lawyers will attempt, in defence of a woman's chastity, to obtain an opinion when, for instance, the last possible date of connection is five months, and a fœtus is born which might be of three, four, or five months' development. The great variability in development renders it essential for the medical witness to fix reasonably wide limits and to leave the decision to other evidence and to the jury.

With regard to the question of live birth in immature fœtuses, *vide* "Live Birth", Vol. II. At seven months the fœtus becomes "viable", that is, capable at law of a separate existence, but it may survive if born as early even as the fifth month.

Age between Seven Months and Full Term, Nine Calendar Months

The following description of the child between seven and nine months corresponds very closely with those in most text-books on midwifery:

"*Between the Seventh and Eighth Months.* The child measures between 14 and 15 inches in length, and weighs from three to four pounds. The skin is thick, of a more decidedly fibrous structure, and covered with a white unctuous vernix caseose which now first appears. Fat is deposited in the cellular tissues, whereby the body becomes plump; the skin previously to this is of a reddish colour, and commonly more or less shrivelled; the nails, which are fairly firm, do not quite reach to the extremities of the fingers; the hair becomes long, thick, and coloured; ossification advances throughout the skeleton; the talus shows a centre of ossification; valvulæ conniventes appear in the small intestines; and meconium is found occupying the cæcum and colon. The testicles in the male are considered about this period to make their descent, towards the scrotum. The time at which these organs change their situation is probably subject to variation: in the abdomen at the seventh, and in the scrotum at the ninth month, at the eighth month they will commonly be found in the inguinal canals. Its absence from the scrotum at birth does not necessarily indicate that the child is immature, because the organ sometimes does not reach the scrotum until after birth, and sometimes not at all.

"*Between the Eighth and Nine Months.* The child is from 15 to 16 inches in length, and weighs from four to five pounds. The membranæ pupillares have disappeared. The quantity of fat deposited beneath the skin is increased, and the hair and nails are well developed. The surface of the brain is grooved or fissured but presents no regular convolutions. The meconium occupies almost entirely the large intestines; and the gall-bladder contains some traces of a liquid resembling bile. The testicles in the male may be found occupying some part of the inguinal canal, or they may be in the scrotum. The left testicle is sometimes in the scrotum, while the right is situated about the external ring. A centre of ossification appears in the lower epiphysis of the femur.

birth of a child weighing 18 lbs. 15 ozs., and lengths of 24 and 32 inches also exist."

By the end of the ninth month the centre of ossification in the lower epiphysis of the femur measures about a quarter of an inch in diameter. Great stress is placed on the size of this point of ossification in the lower epiphysis of the thigh-bone (femur) in its bearings upon the maturity of the fœtus. This point usually makes its appearance at the 36–37th week; at the 37–38th week it is commonly about one fourth of an inch in diameter; and at the full period it is one-fourth to one-third of an inch in diameter. When this point of ossification has reached this size it may be confidently affirmed

Age lunar mo.	Length (L) Cm	Surface Area (S) Sq cm	Weight (W) Grams
Ovum	·4	28·50	·000,000
2	36	—	—
3	90	42	10
4	167	171	100
5	243	408	212
6	311	706	667
7	371	1035	1151
8	424	1430	1754.
9	470	1800	2395
10	510	2178.	3087

$$L = 207.3 e^{-\frac{223.2}{L+1.596}}$$

$$S = 0.2808 L^{2.278}$$

$$W = 0.26 L^{3.108} + 46$$
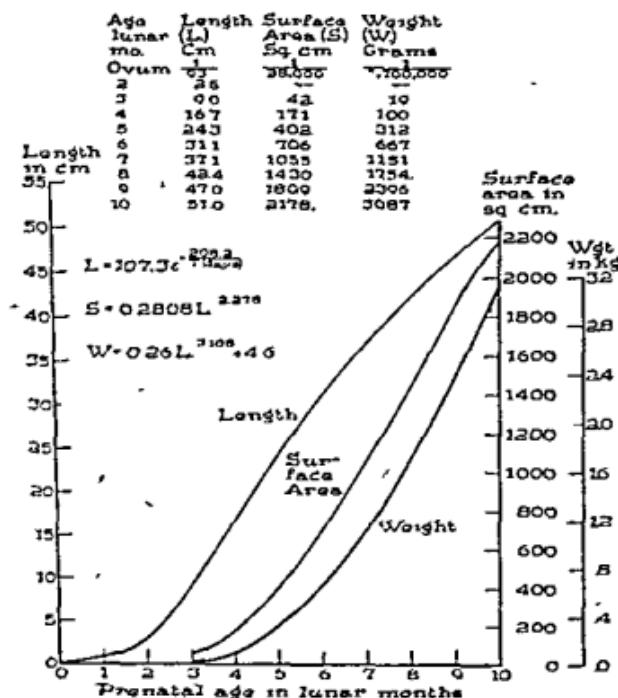
FIG. 13.

(After Edith Boyd, from Scammon in Morris Human Anatomy).

that the fœtus has reached the full period, but the size of the centre is subject to some slight variation. A centre of ossification is usually found in the head of the tibia and one in the cuboid bone of the foot in full-term well-developed children.

At the full term the head of a child forms nearly one-fourth of the whole length of the body. The cellular tissue is filled with fat, so as to give considerable plumpness to the whole form, while the limbs are firm, hard and rounded; the skin is pale; the hair is thick, long, and somewhat abundant; the nails are fully developed, and reach to the ends of the fingers—an appearance, however, which may be sometimes simulated in a premature child by the shrinking of the skin after death. Ossification will be found to have advanced

considerably throughout the skeleton. The surface of the brain presents convolutions, and the grey matter begins to show itself.

The characters given at the different stages of gestation must be regarded as representing an average statement. They are, it is well known, open to numerous exceptions. Twins are generally smaller and less developed than single children; the average weight of a twin child is not often more than six pounds, and very often below this. The safest rule to follow in endeavouring to determine the intra-uterine age of a child is to rely upon a majority of the characters which it presents. That child only can be regarded as *mature* which presents the greater number of the characters found at the ninth month of gestation.

It is convenient to remember that the length of the child in inches is, during the later stages of pregnancy, about double the intra-uterine age in months. Hesse's rule states that the square of the number of months gestation gives the length of the fœtus in centimetres.

Conclusions. The following table may be taken as a summary of the principal facts upon which our opinion respecting the uterine age of a child may be based:—

	6 months	7 months	8 months	9 months
Length	About 12 ins.	About 14 ins.	About 16 ins	18 to 20 ins.
Weight	1¼ to 2 lbs.	3 to 3½ lbs.	4 to 5 lbs.	6 to 8 lbs.
Skin	Red and wrinkled	Paler and smoother.	Sebaceous matter forming.	Copious vernix
Fat	No subcutaneous fat.	Fat beginning to be deposited	Child plump.	
Scrotum	Empty.		Corrugated.	Occupied by testes.
Testes	On psoas muscle.	Near the internal ring.	In canal. (L before R)	In scrotum. (L before R).
Sex	Well differentiated.			
Hair	Lanugo.	Scalp "downy" with lanugo.	—	Hair on scalp an inch long.
Nails	—	Nearing finger-tips.	Reach end of fingers.	Project over fingers. Reach end of toes.
Eyelids	Adherent.	Non-adherent. Eyelashes present.	Well formed.	
Brain	Sylvian fissure formed.			
Intestine	Meconium in small intestine.	Meconium in large intestine.		
Centres of ossification appear	Manubrium and os calcis.	Astragalus. (talus)	Lower epiphysis of femur.	Cuboid, upper epiphysis of tibia.
Placenta weight	9 to 10 ozs.	12 to 13 ozs.	About 15 ozs.	16 to 18 ozs.

The Age of a Child recently Born

We have now to deal with a different class of age data from those we have hitherto considered. These have been entirely directed to proving either that a child could or could not have been the child of particular parentage or that it was or was not capable of extra-uterine life. We have now to consider for how long it has lived, and we assume that there is definite evidence

of some duration of life. Under "Infanticide" will be found a full discussion of the evidence bearing upon this assumption (see Vol. II).

Changes in the lungs, whether gross or microscopic, and changes in the fœtal circulation will not be of much assistance, though they may be of great importance in deciding whether the child was born alive (see "Live Birth"). We have mainly to rely upon changes in the umbilical cord, changes in weight and stature, and the progressive disappearance of the "fœtal" form of hæmoglobin during the first six months in endeavouring to determine the age of a new-born child, and it must be admitted that none of them yields very decisive indications.

Changes in the Umbilical Cord.

These are the most trustworthy of any data we have, for the changes are due to vital processes, and are dictated by conditions of atrophy and healing which pursue a fairly regular course. Thus when the cord is tied and severed in the usual way the portion left adherent to the body begins to dry up in from 12 to 24 hours, and in about 24 hours from birth a ring of inflammation makes its appearance round the site of its insertion. This inflammatory redness must not be mistaken for the thin red circle which is almost constantly present at birth. About the third or fourth day the drying of the cord is complete, and the dried portion separates from the navel about the fourth or fifth day, leaving a raw area which takes from seven to 12 days to heal completely. Hence if a child is found with well-marked inflammation or a raw area at the umbilicus a very reasonable approximation may be made to the time that it lived after birth, though even here the different rates at which wounds heal in healthy and unhealthy children must render the judgment somewhat tentative.

It was formerly stated that if a child had lived two or three days, long enough, that is, for the cord appreciably to mummify, no amount of soaking in water would cause a *restitutio ad integrum* in the dried parts, but this statement is much too positive. A dried cord swells up, and, except that it may be a little darker, it is difficult to distinguish from a cord which has not become dry before soaking. Children's bodies at this age are frequently thrown into water, and in bodies thus recovered a dried piece of cord suggests two or three days' exposure to air before immersion.

Weight.

If we consider the extreme limits for the weights of new-born children and then remember that we have no means of knowing what the weight of a child was at birth, it will be seen that the absolute weight of a child found dead is of no use in estimating how long it lived—when it is probable from other reasons that it was a few days or weeks old.

The body of an infant found in an attaché case at Ashford was too dry to give its weight any significance. The length and the size of the lower femoral and upper tibial ossification centres suggested it was "somewhere about 2 months old". The mother, when traced, said it was four months old: further questioning elicited the important fact that birth was two months premature. To her it was four months old, but its development was that of an infant of about half that age. Ageing could only be approximate.

Height.

Precisely the same reasoning applies to the length of a new-born child. The birth length is too variable, and therefore the initial basis for comparison is not available.

The following may be taken as a summary of the appearances observable

of a nurse (perhaps an accomplice) is bound to exercise great caution. In the event of litigation at a subsequent date, he is expected to be able to inform a court of the condition of the child when first seen by him and of the probable date of its birth. He will not be allowed to throw the blame of a mistake upon others. Success or failure in perpetrating a fraud of this kind will depend upon the doctor's alertness.

R. v. *Ward* was a case of some difficulty respecting the identity of a child alleged to have been murdered. The dead body of a child which had survived its birth was found wrapped in clothing, and concealed near a high-road, by which the woman charged with murder had been seen to pass on a certain day. The doctor who examined the body found that from its state the child had been dead a month, and that it was *some ten days* old at death. The child of the accused had disappeared when it was *about a fortnight* old.

The defence was that the child whose body was found was not that of the accused. The child found, as well also as that of the woman, was male, and had light hair but the age created doubt and, upon this evidence, the accused was acquitted.

This case serves as a warning of the legitimate limits of medical evidence. When the body of a child has been lying putrefying for a month, it is difficult to suppose that it could yield evidence of so fine a point as whether it were 10 or 15 days old.

Estimation of Age in a Child which has survived Birth for a Longer Period

In the absence of documentary proof, the estimation of the age of a *living* child can be only approximate until it arrives at the time when dentition commences. The height and weight may afford some little assistance, but it must be remembered that there is a difference in the rapidity of growth not only in children of a different sex, but also in those of the same sex, and not only in single births, but even in the case of twins. One may flourish and grow the while other remains puny. The average that is ordinarily expected is that a child should measure about two feet by the end of the first year, and should weigh about 20 pounds, with proportionate increase from birth upwards.

The following table and graph gives the average monthly weights of children during the first year of life:—

				lb.	oz.						lb.	oz.
At birth	.	.	.	6	8	7 months	.	.	.		13	4
1 month	.	.	.	7	4	8 ,,	.	.	.		14	4
2 months	.	.	.	8	4	9 ,,	.	.	.		15	8
3 ,,	.	.	.	9	6	10 ,,	.	.	.		16	8
4 ,,	.	.	.	10	8	11 ,,	.	.	.		17	8
5 ,,	.	.	.	11	8	12 ,,	.	.	.		18	8
6 ,,	.	.	.	12	4							

Age from One Year to Puberty

When the teeth commence to erupt they form (see p. 101) the most reliable means for the estimation of the age of a child from about the age of six months to puberty, whether the child be living or dead; it is possible by X-ray examination to corroborate such evidence from the ossification of the bones, for which purpose a table is here inserted of the principal points in such ossification. The figures must not be taken too rigidly, but only as implying

an average. For a review of the subject see Boyd, J. D.)1953) or
Noback, C. (1944).

Boyd, J. D., 1953. In Modern Trends in Forensic Medicine (Ed. Keith Simpson). London.
    Butterworth.
Noback, C., 1944. *Anat. Rec.*, 88, 91.

Appearance of Points of Ossification

		Foot	Hand
5th–6th month, intra-uterine.		Calcaneus (body)	Whole hand cartila-
7th	,,	,,	Talus	ginous during intra-
9th	,,	,,	Cuboid	uterine life.
1st year, extra-uterine.		External cunei-	Capitate and hamate
2nd ,,	,,	form (1–2)	First four metacar-
			pal heads
3rd ,,	,,	Internal cunei-	Triquetral (2–3)
		form. Tarsal	
		navicular.	
4th ,,	,,	Mid cuneiform	Lunate (4–5)
5th ,,	,,	Scaphoid (4–5)	Trapezium (5–6)
			Carpal navicular
6th ,,	,,		Scaphoid
8th ,,	,,		Trapezoid } (6–7)
10th ,,	,,	Calcaneus (epi-	Pisiform (f, 9–10.
		physis) (9–10)	m. 10–11)[1]

Appearance of other Points of Ossification

1st year	Heads of humerus, femur, and tibia.
2nd ,,	Lower ends of radius, tibia, and fibula.
3rd ,,	Patella.
4th ,,	Upper end of fibula, great trochanter of femur (4–5)
5th ,,	Lower end of fibula. Greater tuberele of humerus.
6th ,,	Head of radius. Lower end of ulna.
8th–9th years	Rami of ischium and pubis. Olecranon.
10th–11th ,,	Trochlea of humerus. Lesser trochanter of femur.
12th–14th ,,	External condyle of humerus.
14th–16th ,,	Acromion, iliac crest, lesser trochanter.
17th–19th ,,	Tuber ischii (17 in female, 19 in male). Inner clavicle 20–21.

By 18-20 years   the epiphyses of the long bones of hand and foot should
                  have united to the diaphyses.

„ 20   „   the epiphyses of the fibula should be united to the diaphy-
                  sis. Distal radius unites.

„ 22   „   the inner (secondary) epiphysis of the clavicle fuses.

„ 25   „   the crest of the ilium and the articular facets of the ribs
                  should be united.

The female is usually a year or so ahead of the male in fusion dates.

If all the epiphyses are found united, the individual is almost certainly
over 25 years of age. and if the three parts of the sternum are united by bone
he is almost certainly 35 or over.

As stated above, these points can be investigated with almost the same
accuracy in the living as in the dead by means of X-rays.

There is a tendency for the epiphyseal centres to appear earlier and for
the union of epiphyses to the shafts to take place earlier in the female.
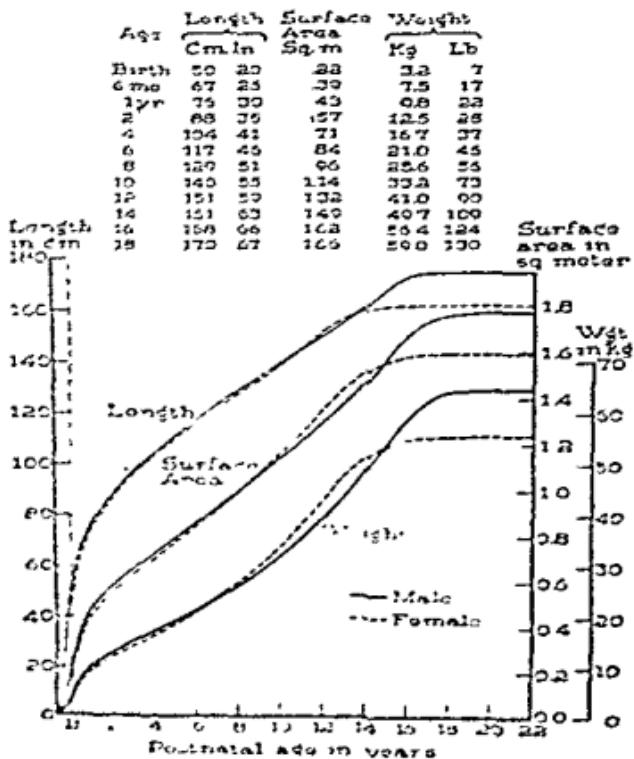
Fig. 14.
(After Edith Boyd from Scammon, in Morris' Human Anatomy.)

earlier in females as compared with standards recognized in temperate climates. Hepworth[1] and Pillai[2] have come to the same conclusion about ossification in India.

Height and weight are too variable to be of much use, but the foregoing table and graph shows the averages with which a given individual may be compared.

Sex changes. The gradual growth of hair on the pubes, commencing with a soft downy growth at about 10 to 13, is a little more reliable, showing at least an approach to puberty. The development of the breasts in girls is variable. In boys the voice undergoes a marked change as puberty comes on, losing its shrill infantile treble and taking on a deeper note, tenor or bass—"the breaking of the voice" in common speech. It must be stated that tastes, habits, and inclinations usually vary somewhat with age in children (comparing only members of the same sex), but some boys of 15 are almost men in these respects, and others still children; and the same may be said of girls, some of whom are married at 16, while others at the same age are still school-girls.

Precocity. Cases of extraordinary precocity, although not frequent are by no means rare: many cases of menstruation in girls from six years of age are reported, with excessive development of the breasts and pubic hair.

Ken[3] records the case of a girl aged six years ten months who began to menstruate at the age of three-and-a-half years. She had well developed breasts and a prominent mons veneris on which there was fine dark hair. The uterus was almost of adult size.

Tumours or excessive development of the suprarenal cortex or of the pituitary gland will, of course, result in anomalies of sex development (see p. 112).

Age in Adults

After the age of 25 the estimation of age becomes more uncertain, whether in the living or the dead. It is true that common knowledge comes more or less to our aid, enabling us to make a fair approximation to the decade within which a person may be, but any closer approximation must be made with considerable reservation. Premature ageing may easily be produced by illness, malnutrition, suffering, anxiety, or worry; white hair often comes on in quite young people from grief or shock, and often for no reason that can be estimated; calcified arteries and arcus senilis (in the eye) are rarely seen before 40, but after that age they are of little value in estimating the age.

It is difficult to achieve an accuracy of even five years in estimating the age after the full permanent dentition and fusion of all centres of ossification have become established—that is, at about 25 to 25 years. The ossification of cartilage in the hyoid, larynx and ribs, the fusion of the greater horns of the hyoid to the body and of the manubrium and xyphisternum with the body of the sternum, changes in the appearance of the cartilage lining the joints and lipping of the bones, all of which occur somewhere between 40 and 60, may be suggestive of advancing age but give no precise evidence. The gradual loss of teeth and changing shape of the lower jaw as it becomes edentulous equally offer no data of precision.

[1] Hepworth, S. M., 1929, *Indian Med. Gaz.*, 64, 128.
[2] Pillai, M. J. S., 1936, *Indian J. med. Res.*, 23, 1015.
[3] *Brit. med. J.*, 1937, ii, 620.

Other sources of information on adult age such as that suggested by Gustafson[1] (see p. 102) may give further evidence of this important matter of age.

It is manifest that no one of the observations can be relied upon to give a precise age but a careful consideration of all may enable us to give an approximation of value to the investigating authority.

Medico-legal Questions concerning Age

The following preliminary remarks are of general application to all ages, and have a very special bearing on the duty of accoucheurs.

A child is not regarded by the law as born until it is "completely proceeded from the body of the mother"; no mention is made of the severance of the cord, nor of the expulsion of the placenta, neither of which has in law any reference to the birth of the child, which is concluded directly the whole of the child has left the vulva. (vide "Infanticide"). When a child is being born about midnight, if the presenting part be born before midnight and the remainder after that hour, the birth must be registered as having occurred on the day after the commencement of the parturition.

In law a child arrives at a given year of age at the first instant of the day preceding his birthday, in the common meaning of that word; and in thus reckoning days no account whatever is taken by the law of parts of a day; thus a child born at 11.59 on the night of May 3rd, 1933, is in law 21 the first moment after midnight of May 1st, 1954. It is obvious that in deciding cases of this sort nothing short of conclusive documentary proof or sworn evidence of reliable witnesses to the act of parturition will be accepted.

Evidence as to age may be demanded in the following circumstances:—

(a) As an aid to identification.
(b) In questions of criminal responsibility.
(c) In questions of rape and sexual offences.
(d) In connection with the competency of a witness.
(e) In the making of wills, etc.
(f) In contracting marriage.
(g) As regards capacity for procreation (involving impotence, legitimacy, etc.).
(h) In connection with civil employment and in protection of children.
(i) In connection with recruitment for military service.

Age in Identification. An approximate age is, of course, an important link in any chain of identity data, but there are so many other points in identity which have been fully discussed that precise evidence as to age is not of much intrinsic value by itself except in very rare circumstances, such, for instance, as in cases where a baby some few days old is alleged to be the new-born child of a lying-in woman.

In Questions of Criminal Responsibility.[2] Infants are divided into three classes according to criminal law:

"(i) Those under eight[3] years of age. There is conclusive presumption that children so young cannot have mens rea at all. Nothing, therefore, which they do can make them liable to be punished by a criminal court; so a child

¹ Gustafson, G., 1950 J. Amer. dent. Ass., 41, 45.
² Kenny in "Outlines of Criminal Law", 1943, pp. 56 et seq.
³ The age of immunity was raised from seven (as at Common Law) to eight
by the Children and Young Persons Act, 1933.

of six, who was arrested for crime, obtained damages from the arrestor. But it is not illegal for parents to administer domestic punishment to such children, if they have in fact become old enough to understand it."

"(ii) *Between eight and fourteen.* Children under 14 are presumed to be *doli incapax*, but this presumption can be rebutted by cogent evidence that the child knew that what he was doing was wrong. Thus, when a child between eight and fourteen is charged with a criminal offence, before he can be convicted the jury have to be satisfied:—

(a) That he committed the act or acts charged.

(b) That at the time he had guilty knowledge that he was doing wrong.
      (See in this connection *R. v. Gorrie* 83 J. P. 136 and *R. v. Kershaw* 18 T.L.R.

"(iii) *Between 14 and 21.*[1] A boy knows right from wrong long before he knows how to make a prudent speculation or a wise will. Hence at 14 an infant comes under full criminal responsibility."

By sec. 52 of the Children and Young Persons Act, 1933, no child under 14 can be imprisoned; and no young person can be sent to penal servitude or imprisonment–(unless unruly). By sec. 53 sentence of death is not to be pronounced or recorded against a person under the age of 18.

The following table gives the various definitions of "child" and "young person" as to age:—

For registration and notification	At least 28 weeks of intra-uterine life (Births and Deaths Registration Act, 1926).
To commence school	At least five years (Education Act, 1944.
To continue at school	Till 15 (Education Act, 1944)
If blind, deaf, defective, or epileptic	A child is a child till 16 (Education Act, 1944).
Restrictions on employment	Under 12, general prohibition. Between 12 and 18, on specified conditions, subject to bye-laws made by a local authority (Children and Young Persons Acts, 1933 and 1938). Medical practitioners may give certificates as to the probability of a child's being injured by his work.

By the Children and Young Persons Act, 1933, "Child" means a person under 14; "Young person" means a person who has attained the age of 14 years and is under 17.

Age in Rape and Sexual Offences. The law has made certain definitions relating to age which are very important:

"(i) A boy under 14 is presumed to be **incapable of rape** as a principal in the first degree, i.e., as the actual perpetrator of the offence, and even of committing an assault with intent to rape. Whether this (in certain cases) is wise or not is a matter with which medical men have nothing to do: they have simply to decide whether the boy is 14 or not. If the registration-of-birth certificate can be produced this is conclusive. In the absence of such a certificate, the teeth and pubic hair are the most reliable forms of evidence.

[1] Kenny, *loc. cit.*

The size and development of his sexual organs may have produced severe injury upon the girl, and may suggest his being over 14, but the defence will require proof, not mere probabilities.

"(*ii*) To have connection with a girl under 13 is a felony, and consent is no excuse where the girl is under 16[1]. Where the accused is a man of 23 years of age or under, the presence of reasonable cause to believe that the girl was over 16 years of age shall be a valid defence on the first occasion upon which he is charged with such an offence (*R.* v. *Ford*).[2] In *R.* v. *Chapman*[3] it was decided that this defence is available until the 24th birthday of the accused.

Competency as a Witness. An infant of any age may be sworn as a witness provided that such infant appears to understand the nature of the oath. Competency depends not on age but on understanding. Where an infant is tendered as a witness it is for the judge to determine whether such infant really understands the obligation of an oath, and it is the duty of the judge in any such case to take steps to ascertain the state of the infant's knowledge. There is a discretion in the judge to postpone the trial for an infant to be instructed as to the nature of an oath. If an infant does not understand an oath his evidence may still be given if in the opinion of the court or judge he is sufficiently intelligent to know that he is under a duty to speak the truth. But no accused person can be convicted of any offence on the sole evidence of an unsworn infant. There must be some sworn evidence corroborating the evidence of the infant in some material particular implicating the accused person.

The Children and Young Persons Act, 1933, contains special provisions relating to the manner in which the evidence of a child of tender years may be received by the court. In this connection, see *R.* v. *Moscowitch*[4] and *R.* v. *Marshall*[5]. For a case where medical corroboration of a child's evidence was very important, *vide* under "Wounds".

In the Making of Wills, Borrowing Money, Pledging Credit, etc. The law does not allow persons under 21 years of age the full power of disposing of property by will or even by gift; nevertheless, it permits persons to fix the age at which a legatee may assume full control of a legacy, but, as a broad general rule, no debt can be recovered by legal process from a person under 21. The matter has, however, but little interest for the medical jurist, for in all such (and in many other) cases documentary evidence of age will be required, and not merely medical evidence.

In contracting Marriage. The statutory age in England is 16 for both sexes.[6]

In Procreation, etc. Before puberty, which is very variable in its onset, a boy is naturally sterile, though he need be by no means impotent. A girl before puberty is not necessarily either sterile or impotent, for cases are recorded of girls bearing children before menstruation (which is taken as the proof of puberty), and the vulva and the vagina are certainly capable, long before puberty, of receiving the male organ. At the other end of life there is

[1] *Criminal Law Amendment Act*, 1922; see also *Age of Marriage Act*, 1929.
[2] (1923), 17 Cr. App. Cas. 99
[3] (1931), 23 Cr. App. Cas. 63.
[4] (1924), 18 Cr. App. Cas. 37.
[5] (1925), 18 Cr. App. Cas. 164.
[6] *Age of Marriage Act*, 1929.

no known limit, while life exists, either to potency or fertility on the part of a man; and although women become sterile after the menopause, they are never impotent merely on account of age. The matter will be referred to again in discussing impotence and sterility.

Age in Civil Employment. See above table under "Employment".

The Children and Young Persons Acts 1933 and 1938 relate to the employment of persons under the age of 18 years. The Acts contain provisions intended to discourage juvenile smoking; and they prohibit, among other things, the giving of intoxicating liquor to children under five.

IDENTITY OF MUTILATED REMAINS

A dead body may be found partly putrefied or mutilated, and other parts of it may be discovered in localities distant from each other. There is less difficulty here in making out identity than when bones only are discovered, for it is not always easy to say whether certain bones belong to the same skeleton or not. So long as the soft parts are attached to them, there will usually be no difficulty in forming an opinion. Those who commit murder, and thus dispose of a body, believe that identification must be a hopeless task if they deposit the different parts in remote places. In this respect they are generally deceived, for a satisfactory reconstruction may still be forthcoming.

Naturally, the first point in identification must be to determine that the fragments are of *human* origin.

A tin box, seen lying in a shallow Surrey ditch, was found to contain a larynx and trachea with lungs attached—but the tongue and heart had been cut off. The Police Surgeon who was called to decide whether the remains were human decided they were those of a child. Had he measured the windpipe, which was ten inches long, he could not have failed to appreciate that this was impossible: the adult human trachea measures only four and half to five inches. The characters of the tongue and heart suggested they were derived from a sheep or calf.

If merely pieces of muscle or viscera are found it may be difficult to decide by ordinary means but the precipitin test, described on p. 354, should enable the examiner to arrive at a correct opinion about their origin.

In *R. v. Haigh* (Lewes Assizes, 1950) the human remains by which identity was established after disposal of the victim in strong commercial sulphuric acid included three facetted gallstones. In the core of one of these there was sufficient protein matter to give a positive human precipitin test.

of Greenacre, there was a disposition to refer the first portion of the mutilated remains which were discovered to a wanton act of this kind. The erroneousness of this view was proved only by the subsequent discovery of the corresponding parts of the body and the detection of the murderer. So in reference to the case of Parkman, the mutilated remains were at first described as anatomical preparations. Such an hypothesis is, of course, favourable to the escape of criminals, and is purely prejudicial to the course of justice. It points out to the assassin an easy method of deceiving the public; and it shows that if he only mutilates a corpse by removing and destroying the head, hands, and feet, leaving the remainder of the body to be discovered accidentally, he has a far better chance of escaping detection and punishment than by attempting to conceal the entire murdered body. The Waterloo Bridge case formed no exception to the protection thus unintentionally extended by public opinion to a foul act of murder. Anyone acquainted with anatomy and the dissection of bodies would at one perceive from the description that no portion of this body could have been used for such a purpose. Medical students do not, as part of their anatomical pursuits, hack and mangle a dead body so as to destroy muscles, vessels, nerves, and spinal marrow; they have no reason to make away with those parts by which a body may be identified, or to boil and salt the remainder; they do not receive corpses with their clothes for dissection, nor is there any conceivable reason why, if they did, they should produce cuts and stabs and stains of blood on the inside of the clothes with such accuracy as to correspond to the effects of wounds inflicted on a living man."

The parts should be fitted together as accurately as possible. When isolated bits are found at different times they should be carefully preserved in Kaiserling or other solution so that they may be matched with parts found at a later period.

It should be ascertained to what treatment the parts have been subjected, for example, whether they have been boiled, burnt, or treated with chemicals.

If vital organs or large vessels are available, it should be noted whether injuries have been inflicted which might have caused death, and whether any injuries found were inflicted before or after death.

If the head is available the teeth may afford most valuable assistance in identity: care must be taken to see that teeth do not fall out.

All scraps of clothing, wrappings, packing, etc., should be preserved as they may belong to the person who carried out the dismemberment; newspapers may be helpful in connection with the date of the crime.

In *R. v. Ruxton* (Manchester Assizes, 1936) fragments of a *Sunday Graphic* newspaper found in one of the four bundles of human remains in a ravine at Moffat (on the Edinburgh-Carlisle road) were identified as parts of a special "slip" edition sold only in Morecambe and Lancaster (where Dr. Buck Ruxton lived) on September 15th, 1935. Evidence was given of the delivery of a copy of this edition at Dr. Ruxton's house on that day. The remains were those of Mrs. Ruxton and of Mary Rogerson, a nursemaid, both of whom lived at No. 2 Dalton Square, Lancaster with Dr Ruxton.

Any personal articles such as jewellery, watches, and so on, may provide important clues of identity.

In 1950 a mummified forearm and right hand, either avulsed or explosively blown from the body, was found in the loft of a house at Brighton. There was a gold ring on the third finger. Enquiries revealed that in September, 1940, an enemy bomb had fallen on a house on the opposite side of the street, killing a number of persons: one of these was a Mrs. Maud Tucker, whose brother, when traced by the police

identified the gold ring as that worn by his sister. The records showed that the roof of the premises in the loft of which the remains had been found had suffered damage at the time the bomb fell, the two houses facing each other across the street.

The following cases are very instructive on all these points:

R. v. GREENACRE

In the case of the woman Brown, murdered by Greenacre in 1837, the head, trunk, and limbs were scattered in widely distant parts of London. The limbs were not found until six weeks after the trunk, and then at a considerable distance and under very different circumstances. In the examination of the trunk, it was observed that the fifth cervical vertebra had been sawn through, leaving only about the tenth of an inch of that bone. When the head was found it was observed that the fifth cervical vertebra had also been sawn through, leaving only the posterior spinous process. On comparing the head with the trunk they fitted exactly, even to the continuation of a superficial cut on the skin. On afterwards comparing the trunk with the legs it was ascertained that the cut surfaces exactly corresponded. The thigh-bones remaining attached to the trunk, had been sawn through about an inch below the trochanters, to about one-half of their thickness, and then broken off. When the limbs were discovered six weeks afterwards, the portions of thigh-bones found exactly corresponded in the marks produced by the saw and in the portions broken. Not only were the parts of the body thus proved to belong to one and the same woman, but the individual was further identified by the peculiarity of the absence of a uterus.

BRIGHTON "TRUNK" MURDER

On the occasion of a murder perpetrated at Brighton the head and subsequently the body of a female were found in different and distant places. They were identified as belonging to the same individual: first, from the fact that there were four cervical vertebræ attached to the trunk and three to the head: and secondly, from the divided vessels and cartilaginous rings of the trachea exactly corresponding. The importance attached to this kind of anatomical evidence shows that when a portion of a dead body is found, the whole of the parts which form the boundary of the section should be attentively observed and accurately described.

MURDER OF DR. PARKMAN

The case of Dr. Parkman, for the murder of whom Professor Webster was tried and convicted at Boston, U.S., in March, 1850, presents a remarkable instance of the value of scientific evidence in establishing the identity of a mutilated body. It also proves that even all the refinements of science *may* fail in the attempt so to dispose of a dead body in a case of murder as to prevent its identification. On November 23rd, 1849, the deceased was traced to the laboratory of the prisoner, and from that date he was missing. A week after his disappearance there were found concealed in the vault of a privy belonging to the prisoner's laboratory a pelvis (the hip-bones), the right thigh (from the hip to the knee), the left leg (from the knee to the ankle); and with them certain towels bearing the initials of the prisoner. Among some cinders and slag connected with a furnace were found portions of bones, apparently of the cranium, fragments of vertebræ, blocks of artificial teeth, and some gold which had been melted. On the day following, in a remote corner of the laboratory, there was found a tea-chest, containing, embedded in a quantity of tan and covered with minerals, the entire trunk of a human body with the left thigh from the hip to the knee. When the parts were placed in apposition with the portions previously found, they corresponded, so that they were obviously parts of

Fig. 15
Dr. Parkman's skeleton restored. The missing parts are black.

the same body. This observation also applied to the remains of bones (cranium and vertebræ) found in the slag of the furnace. There was no duplication. All the fragments fitted so as to form part of the same human skeleton. The portions thus found resembled in every particular the body of Parkman, and in no single particular were they dissimilar from the body of the deceased. There were missing from these remains, when they were placed in apposition, the head, the arms with the hands, both feet and the right leg from the knee to the ankle.

The parts found, which are light in the engraving (Fig. 15), were examined by several medical men. They deposed that they were human remains, parts of one and the same male human body; that they had not undergone dissection for anatomical purposes, and had not been submitted to any process of preservation, further, that they had been cut and hacked in different directions without any reference to their anatomical relations, and evidently by a person only partially acquainted with the structure of the body. The chest was still covered with the muscles and skin. It was noticed that under the left nipple, between the sixth and seventh ribs, there was an opening which penetrated into the cavity. The opening was slightly ragged, and about 1¼ inches in length.

It seems that Parkman was sixty years of age and his stature was 5 feet 11 inches. The portions of the body thus restored were those of a person between fifty and sixty years of age; and with respect to stature, the portions found, extending from the seventh cervical vertebra to the outer ankle (malleolus), measured 57½ inches. The distance from the sole of the foot to the outer malleolus, measured in another subject of the same age, was 3 inches; and the distance from the top of the head to the base of the sixth cervical vertebra was 10 inches. Adding these measurements to the missing portions the total length of the body found would be 5 feet 10½ inches, being within half an inch of the stature of Parkman. There were features of identity about the teeth and jaw which left no doubt that the remains were those of the missing man. The defence of the prisoner rested upon the fact that the charge was based entirely on circumstantial evidence, that the identity of the remains had not been satisfactorily made out, and that no cause of death had been proved. The jury, however, returned a verdict of guilty, and the prisoner was subsequently executed[1].

THE WATERLOO BRIDGE CASE[2]

A singular case involving somewhat similar questions occurred in London in October, 1857, when the remains of a human being were found in a bag on one of the buttresses of Waterloo Bridge. It appeared that they had been accidentally deposited there the night previously—the intention of the person who carried them being, no doubt, to lower them into the river, but by accident they lodged on one of the buttresses of the bridge. A number of articles of clothing were in the bag with the remains. These remains were submitted to the examination of the divisional surgeon of police and Taylor.

They found them to consist of parts of a human body, and obviously of the same body. There were 23 parts discovered, consisting chiefly of bones with flesh adhering to them. The flesh had been roughly cut from the bones, apparently in order to remove as much of it as possible, and to destroy the identity of the body. The parts had been cut and sawn into small pieces, probably to reduce their bulk and to allow them to be packed within a small space. The trunk, including part of the chest and spine, had been cut into eight pieces; the upper limbs had been cut or sawn into six, and the lower limbs into nine pieces. The thigh and elbow-joints were in a strongly flexed condition. The missing portions were the head, with the greater part of the spine, namely, fourteen out of 24 vertebræ (seven cervical and seven upper dorsal), the hands, the feet, and some portions of the left side of the chest. A murderer intending to destroy personal identity would, in general, most effectually succeed in his object by removing the head, feet and hands. The whole of the viscera of the chest and abdomen had also been removed. The 23 fragments found weighed only 18 lbs., about one-eighth of the average weight of the adult body. There was no difficulty in determining the sex of the deceased, as a portion of the sexual organs, which had been mutilated still remained attached to the pelvis. The long bones were in their full state of development. The stature was determined by taking the length

[1] "Report of the Trial of Prof. Webster", by Dr. Stone, Boston, U.S., 1850.
[2] Taylor, A. S. 1857. *Med. Times Gaz.*, 2, 445.

of the portions found, and adding a certain number of inches for the missing skull, cervical vertebræ, and feet. The bones had been sawn through near the joints with a fine bone-saw, such as is used by bone-boilers. On the left side of the chest, between the third and fourth ribs, there was a stab which had penetrated the cavity, in a direction to enter the heart. It had been inflicted on a living body. No portion of these remains had the appearance of having undergone dissection or any preparation or use for anatomical purposes. The muscles, vessels, and nerves had been hacked in all directions, without any reference to relative position. The spinal cord had been violently torn out of the vertebral canal. The joints had been sawn through, evidently with great trouble, at points, where a scalpel, would have speedily effected the separation of the limbs. Further, no preservative of animal matter had been employed. Portions of the muscle skin and ligaments were brown and sodden; they presented the appearance of having been boiled in water and soaked in a solution of common salt. The conclusions from the whole of the investigation were given by Taylor as follows:

(1) That the remains were those of a person of the male sex, of adult age, and of at least 5 feet 9 inches in stature. (2) That the parts found presented no physiological or pathological peculiarities by which they could be identified as belonging to any particular individual. The only fact observable under this head was, that the portions of skin remaining were thickly covered with dark hairs, and that the deceased was probably a dark, hairy man. (3) That the remains presented no appearance of disease or of violent injury inflicted during life, with the exception of a stab in the space between the third and fourth ribs on the left side of the chest. This stab was in a situation to penetrate the heart and cause death. It had the features of a stab inflicted on a person, either living or only recently dead. (4) That these remains had not been dissected or used for the purposes of anatomy. All those parts of the human body which are useful to an anatomist had been roughly severed and destroyed by a person or persons quite ignorant of their anatomical relations. They had been probably cut and sawn before the rigidity of death had ceased, i.e., within from eighteen to 24 hours after death; and in this state had been partially boiled and subsequently salted (placed in brine). The body of deceased had not been laid out or attended to like that of a person dying from natural causes, whose body might be lawfully used for anatomical purposes. (5) That the person of whose body these remains were a part might have been dead for three or four weeks prior to the date at which they were examined, namely, on October 21st, 1857.

The articles of clothing found with the remains in the bag were those of a man and a foreigner. They were much torn, and some presented the appearance of stabs and cuts, while all were more or less stained with blood, some of the stains presenting coagula. A stab through the double collar of an overcoat must have been inflicted with some force, as it was found to extend through corresponding parts of the undercoat and waistcoat. All these articles of clothing had stains of blood on the inside, and chiefly on the left side of the body, in the parts corresponding to the stab on the left side of the chest. The cutting and tearing of the clothing may have arisen from the removal of the clothes while the body was in a state of rigidity in a constrained attitude. The state of the clothes was consistent with their having been worn by the deceased when he was subjected to violence which led to his death.

From inquiries made by the police, there was reason to believe that the remains were those of a Swedish sailor from a vessel then in the river; there was no clue to the perpetrators of this murder.

and a quantity of cord. On September 11th, 1875, a man, employed by Wainwright, was arrested in the Borough, having in his possession two packages wrapped in similar American cloth and secured with similar cord, containing human remains. Upon being opened one parcel was found to contain the trunk, and the other the remaining portions of a thin human female, about five feet high, and about 25 years old. The body, which was supposed to have been dead about a year, had been recently and most unscientifically dissected. It was in a stinking and decomposed state; some parts were more or less mummified, whilst other parts were in a condition tending to adipocere. The body was, roughly speaking, divided into ten parts, as follows: two arms; two hands; the legs and feet connected, and left leg including part of the patella; the thighs including portions of the pelvis (the right thigh included the patella, the left thigh included part of the patella); the trunk, except the front of the pelvis; the head and neck. Though the woman had been dead a year and buried in a grave on the premises, certain parts had been well preserved, owing to the use of chlorinated lime, employed with the mistaken view of destroying the body, whereas it had acted as a preservative.

The cause of death was obvious. There were two bullets in her brain, and a third was found in a hair-pad at the back of the head. There was a cut extending from the centre of the throat to the angle of the lower jaw, which had severed all the tissues, and which must have been inflicted with considerable force.[1]

In this case Taylor's identification of the remains was based partly on medical facts, and partly on the discovery of certain articles of clothing in the grave from which the body had been removed. The features were not recognizable. The body had been cut into ten pieces and much mangled. It was decomposed; but, as a quantity of chlorinated lime had been used in the burial of it, putrefaction had been in some degree retarded. The relatives could only speak generally to the slender form and stature of the body, and the smallness of the hands and feet, as points in which it resembled that of Harriet Lane. The light auburn colour of the hair, the absence of a tooth in the upper jaw on the right side, and the presence or a scar or cicatrix from a burn received many years before, and still remaining on the right leg below the knee, were also circumstances which strengthened their opinion. Some buttons and other articles of clothing found in the grave were identified by her relatives as similar to those which were actually worn by the deceased on the evening of her death. The direct proofs were: (1) *The age.* The age of the deceased was 24. Judging by the wisdom teeth, three of which had appeared, this corresponded with the age assigned to the body. (2) *Stature.* It was inferred, but by no means directly proved, that the deceased was 5 feet 0½ inch in height. The remains, when put together, represented a stature of 4 feet 11½ inches. This makes about an inch difference, which was accounted for by one of the medical witnesses as a result of the shrinking of the intervertebral substance, hence the defective length of an inch was consistent with the remains being those of a person of the height of the deceased. (3) *The colour of the hair.* This is stated to have been slightly different; but the difference was consistent with the hair of the remains having been buried for a year in the earth, and exposed to the action of chlorinated lime. But there are indeed so many women in the world with hair of a similar shade of colour that no great reliance can be placed on a resemblance of this kind in a disputed case of identity. (4) *The scar.* There was a scar or cicatrix from a burn in the right leg, below the knee. On removing the matter on the body which concealed such superficial marks, it was found in a part indicated by the father of the deceased woman. The scar was distinctly puckered, and presented all the usual marks of a scar produced by a burn from a red-hot poker. (5) *The state of the uterus.* The missing woman had had two children by Wainwright, the last having been born about nine months previous to her disappearance. From their examination of the womb, the medical witnesses for the Crown, Bond and Larkin, came to the conclusion that the woman whose remains were discovered had borne a child.

THE BAPTIST CHURCH CELLAR MURDER

The case of *R.* v. *Dobkin*[2] (C.C.C. December, 1942) has many features of interest. Mrs. Dobkin disappeared on April 11th, 1941, during an air raid on London. Four

[1] The Trial of the Wainwrights. Notable British Trials. London: Hodge.
[2] The Trial of Harry Dobkin, 1944. Ed. by C. E. Bechofer Roberts. London: Jarrolds.
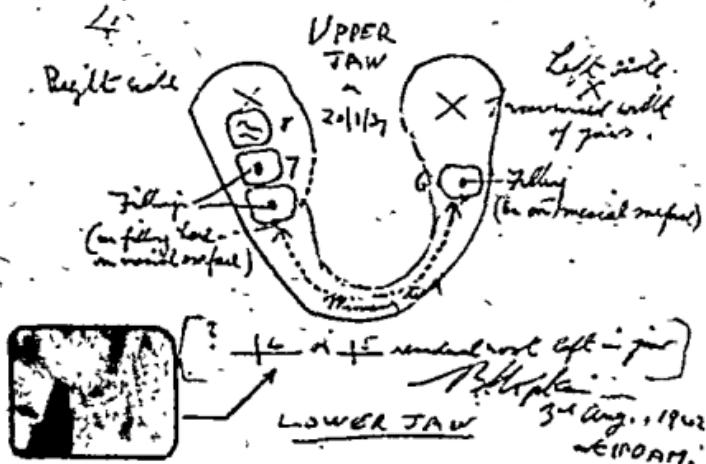
Fig. 16a. Diagram of state of upper jaw of Rachel Dobkin, made by her dental surgeon from his records at the request of police officers making enquiries to establish identity of woman whose remains showed the upper jaw dentition seen in Fig. 16b. An X-ray of the L. upper 4/5 region shows roots thought to have been left after extraction. (*R.* v. *Dobkin*).
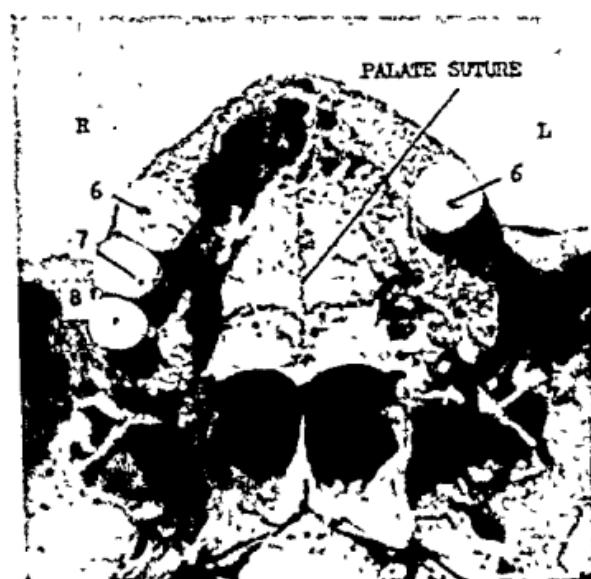
Fig. 16b. Photograph of upper jaw details from skull of remains found buried in Baptist Church cellar to which premises Dobkin was fire-watcher. (*R.* v. *Dobkin*.)

days later a fire broke out on premises adjoining those at which Dobkin was employed as 'firewatcher. *There had been no enemy action that night and no reason for a fire.* Two hours elapsed before the fire brigade was called ... by a passer-by.

Fifteen months later a demolition gang found certain human remains under a stone in the floor of the cellar, covered with earth and lime. These remains, which were partially burnt, consisted of a head, trunk and parts of the arms and legs. *A small quantity of brown hair turning grey was found. In the viscera was a* uterus somewhat enlarged and containing a fibroid tumour. These remains contained no duplicate parts and were evidently those of an adult woman aged about 40-50. The height, as estimated from the humerus, the only long bone available, by Pearson's formula, was about 59½ inches, and, as estimated by assembling the *body, 60¼ inches. A fracture of the right horn of the thyroid cartilage with some* blood clot around gave an indication that the cause of death was probably strangulation.

Enquiries showed that the wife of Dobkin was 47 years of age, about 60 to 61 inches high, had dark brown hair turning grey, and had been diagnosed as suffering from a fibroid tumour of the uterus. A doctor at the hospital recognized a photograph of Mrs. Dobkin as the patient who had attended for that complaint *and had refused operation.*

The teeth proved to be the culminating point in identification (as described on page 100), being an exact counterpart of dental records in Mrs. Dobkin's name.

The X-ray photograph of the skull was superimposed on a full-face photograph of Mrs. Dobkin, and fitted precisely, suggesting at least, as Mr. Justice Wrottesley said to the jury, that this skull could be that of Mrs. Dobkin and not that of some other person.

The Court held that identification was proved and Dobkin was convicted of murder and executed.

' Vaccination marks on one body, and evidence of a bunion on the other, corresponded with conditions in the missing women. The finger nails of the younger were scratched, as might be found in a domestic servant, and her finger-prints were identical with prints found on many articles in the house of the accused. The tips of the fingers and toes of the older body had been removed. With the bodies there were newspapers of the 15th September, certain garments which were identified, and a portion of a sheet which was identical, including a fault in the selvedge, with a sheet found in Ruxton's house.

The disarticulations had been carried out without damage other than small cuts in the cartilages, and were obviously the work of a person with a knowledge of anatomy. There was evidence of asphyxia in the organs assigned to Mrs. Ruxton and there was also a fracture of the hyoid bone. In the body assigned to Mary Rogerson there was a fracture on the top of the skull, bruises on the arms and face, and a deep bruise in the tongue, which showed leucocyte infiltration, suggesting that it had been caused an hour or two before death.

Fig. 17a	Fig. 17b
Head of the younger woman showing the extent of the mutilation.	Skull of the older woman superimposed on a life size photograph of Mrs. R. by Professor Brash.

In the house of the accused a number of human bloodstains were found in the bathroom and on the stair rails, stair carpets and pads; fragments of human tissue were found in the traps connected with the drains and a suit of clothes belonging to the accused was grossly contaminated with blood.

The accused was found guilty of murder and condemned to death.

Identity when Bones only are Left

When bones, a little slimy tissue and possibly a few fragments of clothes are all that are left of a human being, the great majority of points of identification we have considered are not available, but a great deal of information may be obtained by careful and minute examination of skeletal remains, however fragmentary. Naturally, the first question that must be considered

the more there is found; if a *complete* bone is found, or a reasonably large fragment, there should be no doubt on the matter. With small fragments the answer should be given with caution, and the advice of a professional anatomist should always be sought.

Taylor's original remarks on this subject were as follows:—"The greatest ignorance prevails among the public on this subject. The bones of horses, cows, dogs, and sheep are frequently mistaken for those of human beings". In an antiquarian collection of relics obtained from a neighbouring Roman castrum, Taylor recorded finding the tibia of a dog carefully labelled and religiously preserved as the bone of an ancient Roman. The same collection contained fragments of bones of various animals, carnivorous and herbivorous, all marked as human relics. This collection belonged to an antiquary, who had preferred adopting his own view of the nature of the relics to taking the opinion of anyone acquainted with anatomy. In a church in the north of England, two bones from oxen were shown as the thigh-bones of St. Lawrence. They were of ancient date and greatly prized by the sexton. Even well-informed men may be easily mistaken on such subjects. Belzoni, the celebrated traveller, brought from Egypt, with his sarcophagi, a number of bones taken from the interior of the Pyramids, which he pronounced to be the bones of King Cephrenes, and some of the Shepherd Kings. Clift examined them after they had been submitted to public exhibition, and he found that they were the bones of oxen. The osseous relics of saints, as they are collected and preserved in glass and crystal cases in Roman Catholic countries, often present anomalies which would surprise an anatomist. Supernumerary ribs and vertebræ are not uncommon, and intermixed with them bones which certainly never appertained to a human being. Most of us have been consulted about matters such as these for not only laymen but medical practitioners and veterinary surgeons are often led into giving foolish opinions about the origin of bones. It is enough to say that an expert in osteology should always be consulted in difficult cases.

It will be, in most cases, easier to say whether a particular bone formed part of a human skeleton or not than to determine to what animal it may have belonged; this is commonly all that is expected from a medical witness.

At what date after burial or after death the precipitin test ceases to be applicable is not known, but it must be so long an interval that *all* proteins have disappeared entirely.

Assuming that bones are human, the questions that arise are:
(1) Do they represent one or more bodies?
(2) Are they those of a child or adult?—age.
(3) Are they those of a male or female?— sex.
(4) What was the stature of the person?
(5) What was the race?
(6) How long have the bones been there?
(7) Is there evidence of the cause of death?
(8) Can the person be identified by the surroundings?
(9) Identification from fractures and other peculiarities.
(10) Identification of burnt or corroded bodies.

Do the Bones represent one or more Bodies?

This point though obvious must not be overlooked. In old graves there will naturally be a greater chance of multiple burials than in the cases where a murderer has disposed of his victim. Still it is possible that two or

more people (generally children) may have been disposed of at the same time. The only way in which the point can be determined is by finding duplicate bones or too many bones to have belonged to one individual. Polydactylism must not be forgotten.

Age in Skeletal Remains

We have already commented in some detail on this under the heading of "Age in Identity", and have shown that the condition of the teeth and of the *bones* offers the most trustworthy indications of age in the dead. The size of the bones, as well as the degree of roughness of the ridges for muscular attachments, will also give some clue to the approximate age and development of the deceased person.

A hand and a foot were found in a garden in the Isle of Dogs, Poplar, in the process of "burial" by a dog. A young local girl had disappeared some weeks previously after giving evidence against a gang of East End youths, and suspicion of foul play ran high. The hand, however, was a very large and heavy masculine piece, and the foot was a frail and very aged female piece: both had been dissected with care, as in anatomical dissection, and both had been fixed with a carbolic acid compound which still smelled strongly of phenol. X-ray confirmed the difference in bone density and general texture.

It was thought that the bones were those of a girl who might have been murdered; but medical examination showed that the bones must have belonged to two older persons. There are numerous cases in which a question of this kind may become important.

When ossification is once completed it is difficult to determine the age by an examination of the bones. That the person has reached *adult age* will be indicated by the union of all the epiphyses to the bones, by the great firmness and solidity of the bones, with their rough surfaces for the insertion of muscles,
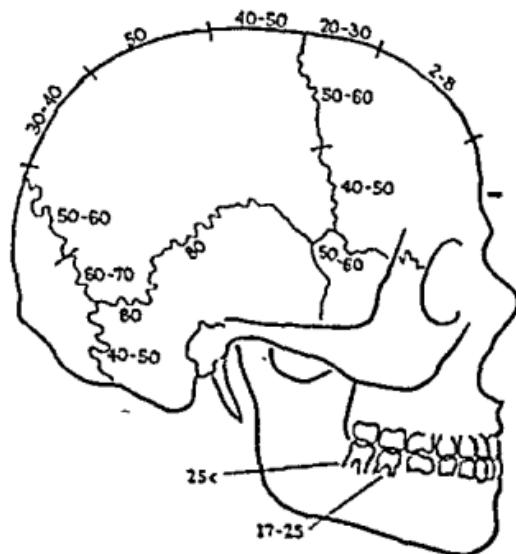
Fig. 18. Approximate time of closure of cranial sutures. The inner aspect closes several years before the outer as a rule. Molar tooth root calcification is also noted.

their well-marked processes, groves, and foramina. In the jaws, we may expect to find the wisdom teeth, while the other teeth will probably be found worn to a degree which may help to assess the age (see p. 101). The cranial sutures begin to be obliterated, especially in the sagittal and coronal sutures before 30 years. The closure is first seen on the inner surface of the skull. The basis for estimation of age from the ossification of bones and dentition data has been set out on p. 131 and p. 101 respectively.

During the adult period the gradual closing of the cranial sutures offers an additional means of age approximation. Though by no means constant, their periodic closure which is shown diagrammatically in Fig. 18 should be helpful in this respect. Todd's contributions to this study are well worth perusal[1]. Although his conclusions are not as reliable as he would suggest we must make full use of any information of this nature which is at our disposal.

During the period between full dentition together with ossification of epiphyseal cartilages and later adult years, several skeletal changes of interest to the medico-legist occur. The billowy appearance of the faces of the symphysis pubis is gradually lost and the characteristic smooth face develops.

As age advances we may observe lipping of the glenoid fossa, and of other joints, textural changes in the long bones—mainly a gradual rarefaction—calcification of the costal and laryngeal cartilages, union of the greater horns of the hyoid with the body, of the manubrio-sternal joint, and various other degenerative changes all of which make up the picture of ageing.

Determination of Age from Stature. In attempting to determine the age of a young person's skeleton from the measurement of the stature or its estimation from bones (see "Stature"), it must be remembered that there is a great difference in the rapidity of growth, not merely in children of different sexes, but in children of the same sex. Sometimes a child will be much under the average stature before puberty, but will grow rapidly after having passed this period. The graphs on p. 132 may be referred to.

Sex in Skeletal Remains

The determination of sex from an examination of the skeleton or certain detached bones can more readily be made in subjects which have passed the age of puberty, for sexual differences in the skeletons are not definite until adult age has been reached. The skeleton of the female is generally smaller and more slender than that of the male. The full-grown bone of a female is distinguished from that of a male by its ridges, depressions and processes being less marked, the shaft of a long bone is smoother and more polished, while the articular surfaces and ends are smaller.

If the whole skeleton is available there should be no difficulty in arriving at an accurate estimation of the sex but obviously when only part of the skeleton is available the difficulty of assessment increases.

The greatest difference is observed in the pelvis, and it is by an examination of this portion of the adult skeleton, when it can be obtained, that the sex may be most satisfactorily made out. These differences are noted in every textbook on anatomy, and only a few details need be added here.

The bones of the male pelvis are more massive and rougher, the curve of the iliac crest reaches a higher level, and its posterior extremity curves down

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[1] Todd, T. W., 1939, in Problems of Ageing. Ed. by E. V. Cowdry. Baltimore: Williams and Wilkins.

more steeply to its termination. The pubic angle is narrower in the male; the body of the pubic bone is narrower and the pubic ramus much wider than in the female. The great sciatic notch is much narrower in the male than in the female and the appearance of the pre-auricular groove in the latter is well defined. (See Fig. 19c).

(a)

Fig. 19. (a) Part of L. os innominatum extensively eroded by acid super-imposed over female bone of about the same age as victim. Only a broad basis for comparison is present.

(b)

(c)

A close-up view of the same bone (b) showing the remains of the pre-auricular groove. A comparable groove in an intact specimen (c) is set alongside. Only an experienced anatomist is likely to recognise such small but vital detail. The groove occurs only in the female.

(R. v. Haigh, reproduced by courtesy of the Commissioner of Police in the Metropolis, New Scotland Yard.)

The **Skull** offers several points for sex appreciation but in general *it is wise* to submit the specimen to an expert anatomist for his opinion. Certain racial characteristics in the skull tend to obscure the sex differences and unless the race is known precise diagnosis of sex becomes very difficult.

In the **Spine** the first cervical vertebra offers some help in diagnosis. It has been stated[1] that the mean breadth in the male is 83 mm. and in the female 72 mm. but the difference in a particular case might be so slight as to make this measurement of little practical value.

There are certain sexual differences in the **sacrum** which are described in any good textbook on anatomy.

In the **sternum** the male body is generally at least twice the length of the manubrium, whilst in the female the manubrial length is nearly always greater than half the sternal body length. Further, the breadth is, in relation to the length, narrower in the female.

The **long bones** have certain sex differences. In general the joint surfaces are greater in the male even when the stature is the same. *For example in* the head of the humerus the boundary between male and female lies between 45 and 46 mm. for the vertical and between 41 and 42 for the transverse measurements of the head as originally pointed out by Dwight.[2] Pearson[3] considered that something over 43 mm. in the vertical measurement in the male and under 44 mm. in the female could be taken as safe guides. In the case of the femur, Pearson considered that a vertical diameter in the head of less than 41·5 mm. indicated a female and of over 45·5 mm. a male. A bicondylar width of less than 72 mm. or more than 78 mm. had a like significance.

Perfect has reported a case which shows the importance of attending to *sex in* skeletons. Two brothers lived together on a farm. The younger of the two was dissolute and irregular in his habits, so that they lived unhappily. One night, when the ground was covered with snow, the *younger brother* absconded from the house and, next morning, his footsteps were clearly traced in the snow to a considerable distance, but there were no footsteps of any other person. Nothing was ever afterwards heard of the missing brother. The elder brother left the farm, and it passed into the hands of a stranger. During the progress of some alterations in the grounds surrounding the house a skeleton was dug up. It was immediately conjectured that the one brother had murdered the other; an investigation was called for, and an inquest was held. Perfect, who was not summoned as a witness, requested permission to examine *the bones; he found that they represented a person of short stature; and from* the obliteration of the sutures of the skull, and the worn state of the crowns of the teeth he inferred that they must have belonged to an aged person. On examining the *bones* of the pelvis it was obvious that they were *female*. When this fact was communicated to the jury, the two medical men, who had given their opinions from a hasty examination, were sent for, and one of them immediately agreed that the skeleton was female. A heavy suspicion of fratricide was thus removed from an innocent man. On further inquiry it was ascertained that the bones had been removed from an old gravel-pit, where gipsies had been accustomed to assemble and where they occasionally buried their dead.

Identity from Fractures, Developmental Abnormalities or Disease

The existence of *fractures*, and the progress which may have been made towards their union, may also become an important subject of *inquiry.*

[1] Clavelin, P., and Derobert, L., 1946, Osteometrie anthropo-medico-legale, Vol. I, Paris, Baillière.

[2] Dwight, T., 1905, *Amer. J. Anat.*, 4, 192.

[3] Pearson, K., and Bell, J., 1919. A Study of the Long Bones of the English Skeleton, C.U.P.

The body of Dr. Livingstone was identified partly by means of an old fracture of the humerus. In general the past existence of a fracture is easily determined by the appearance of a knot or ridge, or in some cases a thick deposit of bone where union has taken place; moreover, the marrow canal is likely to be obliterated at the point of fracture. In a fractured bone which has united in a curved form, it will be observed, on making a section, that the shell is considerably thicker on the side which has had to bear the greatest weight or pressure. All these facts, trivial as they may appear, may in reality be material in a case of disputed identity, and, unless carefully observed at the time, valuable evidence may be lost.

Questions of identity in relation to skeletons may occasionally be solved by reference to certain special characters of the bones. They may bear some developmental peculiarities, such as supernumerary fingers or toes, which, if observed, may tend to throw some light upon the case. An instance of this kind is mentioned by Orfila.

A man who had been residing in a small village in the neighbourhood of Montpellier, suddenly disappeared. It was some time afterwards reported that he had been murdered. It was only after the lapse of more than two years, that the magistrates were first induced to direct an investigation of the case. A thorough search was ordered, and the remains of a body, chiefly the bones, were found buried in a garden. It was, of course, essential to identify this skeleton as that of the deceased. It was well known that he had suffered from a singular personal deformity in having a sixth finger on the right hand and a sixth toe on the left foot. The bones, which were nearly all perfect, were carefully removed and put together, when it was found that those belonging to the two smaller toes of the left foot were wanting; but the metatarsal bone of the fifth toe had a process on the outer side, with a small articulating surface, which might have formed a supernumerary joint. The fifth bone of the metacarpus was shorter and broader than the one belonging to the opposite hand, while its digital extremity was divided into two parts, of which one formed a smooth, rounded articulating surface in the axis of the bone; while the other, which presented a more flattened articular surface, formed with it an angle of about eight degrees. On attempting to articulate the first phalanx of the little finger, it fitted exactly the first articular surface, and presented on the outer side a distinct groove, the oblique direction of which coincided with the direction of this second surface. This left no doubt of the nature of the peculiarity of structure, although the phalanges of the sixth finger could not be discovered. The left hand and the right foot were complete in all their parts. Other corroborating circumstances transpired with respect to marks of violence on the body, and two prisoners were tried for murder, condemned, and executed.

Deformities of the spine, whether from old injury or disease, rickets, etc., or of the limbs, from fractures or bony ankylosis of joints, are easily observed, and may form well-marked points of identity. Every peculiarity should be noted, for any deviation from the normal may prove to be very important in identification.

were discovered. The medical men to whom the examination of these bones was referred remarked that the body of the fifth lumbar vertebra was compressed and thin, as it is met with in rachitic individuals; that the pelvis was contracted on the left side, that the tibia and fibula of each leg presented a remarkable curvature, greater, however, on the left than on the right side, so that the left leg was *half an inch shorter* than the right. These facts, together with certain dental features and other circumstances, established the identity of the bones as being those of the person *who had been missing*.

Stature from the Skeleton or from Single Bones

The average stature of Englishmen is from five feet six to five feet nine inches, or, according to Galton, five feet eight inches; about four out of one hundred are calculated to have a stature of from six feet to six feet three inches. In determining the stature from the measurement of the *entire skeleton*, it is usual to add from an inch to an inch and a half for the thickness of the soft parts. When the bones have become entirely disarticulated they should be laid out in their natural order and an estimate made.

In the Baptist Church Cellar Murder (*R. v. Dobkin*, C.C.C., 1942) the head had been severed between skull and atlas, and the legs had been cut off, or cut and burned away in the region of the knees. Reassembling the body, giving due allowance for the parts missing at the knees, gave an estimated height of 5 feet 0½ inches. Pearson's formulæ, using the only intact long bone present (the left *humerus*) gave a height of 4 feet 11½ inches. The evidence given was that, in life, the victim would have stood about 5 feet to 5 feet 1 inch.

In *R. v. Christie* (C.C.C., 1953) the stature estimations made from the *four* principal long bones (f.h.t.r.) and their separate sums (e.g., f. + t.) confirmed the existence of "a systematic negative error" using the Pearson formulæ (R. J. Harrison). The Dupertuis and Hadden general formulæ and the Trotter and Gleser formulæ gave mean errors of 0·14 cm. and 0·16 cm. – negligible errors. A variance ratio test showed no significant error with the latter two methods at the 5 per cent level. The actual height of Ruth Fuerst was 172·7 cm. Pearson's formulæ gave a mean of 165·3 cm., Dupertuis and Hadden 171·3 cm., Trotter and Gleser 172·7 cm. The same under-estimation was evident in a re-examination of the Ruxton and Rogerson statures which Harrison[1] made during the reconstructions in the Christie case.

and American Whites and Negroes (Dupertuis and Hadden[1]). The latter authors concluded that the cadaver stature was, for all practical purposes, the equivalent of the living stature, not, as Manouvrier had suggested, as much as 2 cm. greater. This has subsequently been shown to be incorrect (*vide infra*).

The whole subject of stature from skeletal remains has received so much attention in recent years that we shall, whilst again reproducing the classical Pearson's formulæ, devote some attention to the recent work of both Dupertuis and Hadden—and of Trotter and Gleser; these latter author's work on the subject promises as great an impact on the subject as Karl Pearson's classical work.

Pearson's formulæ for the estimation of living stature from dry skeletal remains (expressed in cm) were as follows:

$$\left. \begin{array}{l} \text{From the femur: } S = 81\cdot396 + 1\cdot880 \ \ F \\ \text{: humerus: } S = 70\cdot641 + 2\cdot894 \ \ H \\ \text{tibia: } S = 78\cdot664 + 2\cdot376 \ \ T \\ \text{radius: } S = 89\cdot925 + 3\cdot271 \ \ R \end{array} \right\} \text{in males}$$

$$\text{and} \quad \left. \begin{array}{l} 72\cdot884 + 1\cdot945 \ \ F \\ 71\cdot475 + 2\cdot754 \ \ H \\ 74\cdot774 + 2\cdot352 \ \ T \\ 81\cdot224 + 3\cdot343 \ \ R \end{array} \right\} \text{in females}$$

The femur is measured—in a Hepburn osteometric board for accuracy —from the head to the very bottom of the inner condyle: if measured in the oblique and not straight, add 0·23 cm for male and 0·33 cm for female to the length before using the above formulæ. The tibia is measured from the upper articular surface to the tip of the malleolus: if measured with the spine, subtract 0·96 cm for the male and ·087 cm for female before using the Pearson formulæ. The humerus and radius are measured in their greatest length.

Pearson's formulæ for the estimation of stature as a corpse the maximum lengths of the femur, humerus, tibia (without spine) and radius being measured with the cartilage on and in a humid state were as follows:

$$\left. \begin{array}{l} \text{From the femur: } S = 81\cdot231 + 1\cdot880 \ \ F \\ \text{humerus: } S = 70\cdot714 + 2\cdot894 \ \ H \\ \text{tibia: } S = 78\cdot807 + 2\cdot376 \ \ T \\ \text{radius: } S = 86\cdot465 + 3\cdot271 \ \ R \end{array} \right\} \text{in males}$$

$$\begin{array}{l} \text{and} \\ \text{correspondingly} \end{array} \quad \left. \begin{array}{l} 73\cdot163 + 1\cdot945 \ \ F \\ 72\cdot046 + 2\cdot754 \ \ H \\ 75\cdot369 + 2\cdot352 \ \ T \\ 82\cdot189 + 3\cdot343 \ \ R \end{array} \right\} \text{in females}$$

Dupertuis and Hadden analysed figures from dissecting room subjects – mixed (American) White and American Negro subjects – and came to the conclusion that the corpse and living statures were virtually identical. Trotter and Gleser[2], in a most detailed and critical study of the same kind

of mixed stock, American White and Negro, were able for the first time to compare the lengths of long bones with the *known living stature* of American military subjects whose height had been recorded on joining the Army. They found that Manouvrier's original observation of a 2·5 cm increase in corpse (as to living) stature was correct, and using multiple regression equations of stature with the lengths of the long bones produced the following tables—with standard errors: they are undoubtedly a significant advance in this important subject:

WHITE MALES		NEGRO MALES	
$3.08\ \text{Hum} + 70.45$	$\pm 4\ 03$	$3.26\ \text{Hum} + 62.10$	± 4.43
$3.78\ \text{Rad} + 79.01$	± 4.32	$3.42\ \text{Rad} + 81.56$	± 4.30
$3\ 70\ \text{Ulna} + 74.05$	± 4.32	$3.26\ \text{Ulna} + 79.29$	± 4.42
$2.38\ \text{Fem}_m + 61.41$	± 3.27	$2.11\ \text{Fem}_m + 70.35$	± 3.94
$2.52\ \text{Tib}_m + 78.62$	± 3.37	$2.19\ \text{Tib}_m + 86.02$	$\pm 3\ 78$
$2.68\ \text{Fib} + 71.78$	± 3.29	$2.19\ \text{Fib} + 85.65$	± 3.80
$1.30(\text{Fem}_m + \text{Tib}_m) + 63.29$	± 2.99	$1.15(\text{Fem}_m + \text{Tib}_m) + 71.04$	± 3.53
$1.42\ \text{Fem}_m + 1.24\ \text{Tib}_m$		$0.66\ \text{Fem}_m + 1.62\ \text{Tib}_m$	
$\quad + 59.88$	± 2.99	$\quad + 76.13$	± 3.49
$0.93\ \text{Hum} + 1.94\ \text{Tib}_m$		$0.90\ \text{Hum} + 1.78\ \text{Tib}_m$	
$\quad + 69.30$	± 3.26	$\quad + 71.29$	$\pm 3\ 49$
$0.27\ \text{Hum} + 1.32\ \text{Fem}_m$		$0.89\ \text{Hum} - 1.01\ \text{Rad} + 0.38$	
$\quad + 1.16\ \text{Tib}_m + 58.57$	± 2.99	$\text{Fem}_m + 1.92\ \text{Tib}_m + 74.56$	± 3.38

WHITE FEMALES		NEGRO FEMALES	
$3.36\ \text{Hum} + 57.97$	± 4.45	$3.08\ \text{Hum} + 64.67$	± 4.25
$4.74\ \text{Rad} + 54.93$	± 4.24	$2.75\ \text{Rad} + 94.51$	± 5.05
$4.27\ \text{Ulna} + 57.76$	± 4.30	$3.31\ \text{Ulna} + 75.38$	± 4.83
$2.47\ \text{Fem}_m + 54.10$	± 3.72	$2.28\ \text{Fem}_m + 59.76$	± 3.41
$2\ 90\ \text{Tib}_m + 61.53$	± 3.66	$2.45\ \text{Tib}_m + 72.65$	± 3.70
$2.93\ \text{Fib} + 59\ 61$	± 3.57	$2.49\ \text{Fib} + 70.90$	± 3.80
$1.39(\text{Fem}_m + \text{Tib}_m) + 53.20$	± 3.55	$1.26(\text{Fem}_m + \text{Tib}_m) + 59.72$	± 3.28
$1.48\ \text{Fem}_m + 1.28\ \text{Tib}_m$		$1.53\ \text{Fem}_m + 0\ 96\ \text{Tib}_m$	
$\quad + 53.07$	± 3.55	$\quad + 58.54$	± 3.23
$1.35\ \text{Hum} + 1.95\ \text{Tib}_m$		$1.08\ \text{Hum} + 1.79\ \text{Tib}_m$	
$\quad + 52.77$	± 3.67	$\quad + 62\ 80$	± 3.58
$0.68\ \text{Hum} + 1.17\ \text{Fem}_m$		$0.44\ \text{Hum} - 0.20\ \text{Rad} + 1.46$	
$\quad + 1.15\ \text{Tib}_m + 50.12$	± 3.51	$\text{Fem}_m + 0.86\ \text{Tib}_m + 56.33$	± 3.22

(From original of Table 13, Trotter and Gleser, *Am. J. phys. Anthrop.*, n.s. 10, 495.)

Fœtal Bones. From measurements of the stature of 50 newly born children and the subsequent measurements of the dried bones *without* articular cartilages (i.e., diaphyses only) the following ratios have been calculated:

Stature of child =

Femur	.	.	× 6·71	Radius	.	× 9·20
Tibia	.	.	× 7 63	Clavicle	.	× 11·30
Humerus	.	.	× 7·60	Lower jaw (symphysis to condylar surface)		× 10·00

The following tables taken from Tidy's "Legal Medicine", may also be found useful:—

Average Measurement at different Ages, reduced to a Scale of 100

Age	Height	Spine	Circumference of Skull	Humerus	Radius	Hand	Femur	Tibia	Foot	Pelvis	
										Transverse Diameter of	Antero-posterior
Birth	100·00	35·84	79·00	18·50	13·20	16·30	22·00	18·50	18·50	6·80	6·80
2 years	100·00	31·48	65·53	17·40	13·33	11·44	22·94	18·88	13·33	8·14	8·14
4–6 years	100·00	33·71	51·42	18·85	13·71	11·71	26·00	20·28	14·57	7·14	7·14
8–12 years	100·00	29·76	43·72	19·30	14·09	11·86	26·31	21·86	14·65	7·21	7·21
13 years	100·00	30·74	35·70	19·25	13·70	10·55	27·40	21·48	14·81	7·03	6·66
18–19 years	100·00	30·83	33·00	19·00	14·33	11·11	26·38	22·16	13·83	7·83	7·50
Adult	100·00	31·15	31·54	19·54	14·15	11·23	27·51	22·15	16·03	8·00	6·61

Determination of Race from Skeleton

There are certain racial differences in the skeleton, chiefly in the skull and face measurements, and the relative lengths of the upper and lower extremities. The question is more likely to arise in identity problems in seaports, though, of course, it might occur in other parts where foreigners were known to have lived. From the mixed nature of the population in London, Liverpool, etc., cases do occasionally arise in which a decision as to race becomes very material.

It is inadvisable, however, for anyone not experienced in such matters to give an opinion about the racial origin of a skeleton, and the matter should always be referred to a competent anthropologist.

How long have the Bones been Interred?

One of the first questions asked on the disinterment of bones relates to the length of time during which they have remained buried in the ground. The period at which the bones begin to undergo decomposition will depend upon that at which the soft parts have entirely disappeared. The common opinion is, that the soft parts are destroyed in ordinary graves in about ten years, but this depends on many factors, such as the kind of coffin, the nature of the soil, the temperature of the climate, etc. Bernt mentions a case seen by Navier in which some fleshy parts of the body remained after an interment of 21 years. In tropical climates complete destruction of the soft parts takes place with great rapidity, and even in an ordinary English summer we have seen the tissue reduced to a slime in between six and seven days.

The changes in the bones are observed to commence by the loss of animal matter, so that they become lighter; externally they acquire a dark incrustation when in contact with the earth. This dark incrustation is sometimes confined to the surface; but in some very ancient bones the osseous shell is of a dark brown colour throughout. The animal matter is never entirely lost; it exists in bones which have been buried for many centuries, and may be made evident by digesting them in hydrochloric acid. The shaft of a long bone becomes, after long burial in a dry soil, light and very brittle; it may be easily broken, and cut or scraped with a knife. It appears to be impossible to assign, with any approach to precision, the period required for the production of these changes: they vary with the age of the subject, taking place more rapidly in the skeletons of the young; they vary also with the nature of the soil in which the bones are buried, according to whether this is dry or humid, sandy, cretaceous, or clayey: the skull and long bones, and even the perfect skeletons, have been found in ordinary graves quite perfect after

scores of years. If the body has become mummified the bones, cartilages, and dried tissues may remain intact for thousands of years. In general the lower jaw of adults is preserved for a great length of time, and with it the teeth, which resist decomposition longer than any other part of the body. The ultimate destruction of the bone is effected by the complete disintegration of its earthy parts, the phosphate and carbonate of calcium falling into and mixing with the earth around.

Bones owe their preservation to the large proportion of mineral matter contained in them. This is greater in the adult than in the child. Von Bibra found the following proportions of mineral matter per cent in recent bones of different ages: in a woman (*art.* 62), 69·82; in a man (*art.* 25). 68·97; in a child (*art.* 5), 67·80; in a child of two months, 65·32; in a fœtus of seven months, 65·19; and in a fœtus of six months, 59·62. The proportions in the bones of animals are similar to those of the human adult.

We can form only a rough opinion of the period of interment of bones by the presence or absence of the soft parts, of marrow in the interior; by the firmness and weight or brittleness, dryness, and lightness of the bone. Even these criteria can scarcely be made applicable to bones preserved in durable coffins or vaults; for in this state they are, to a great extent, removed from all the common causes of chemical change.

Devergie states that the bones of King Dagobert were found in a tolerably perfect state at St. Denis, although they had been buried in a vault twelve hundred years. In the year 1868 the skeleton of William Rufus was found in a stone coffin at Winchester, nearly perfect, after 780 years' burial. The skull was in fragments; the vertebræ were almost complete; parts of the pelvis and sacrum (showing the male characters), the bones of the arms, the femora and two tibiæ were found. The lower jaw, with nine teeth, the enamel apparently unchanged, was also discovered. There were no clavicles and only six ribs, and the small bones of the hands and feet had disappeared.

Taylor examined a portion of the scapula and rib of a skeleton which was found 18 inches below the surface in the sandy soil on the top of a hill. The skeleton, which was that of a female, was perfect, excepting the lower ends of the tibiæ and feet, which were decomposed. It had the appearance of having been thrust violently into the ground. There were no traces of soft parts. The teeth in the upper jaw, including the wisdom teeth, were perfect and regular, and the age was considered to be from 23 to 28 years. No hair or articles of clothing were discovered. On analysis the bones were found to contain 72 per cent of mineral matter, and the presence of fluorine was detected in a small quantity of bone reduced to powder. The date of interment was assigned at from fifty to one hundred years.

Bones and teeth which have been long buried may, by percolation of water through the soil, become impregnated with ferric oxide, sulphate of calcium, or carbonate of calcium and magnesium. They are heavy, of a dark brown colour, and generally contain much lime and iron, with fluoride of calcium

In 1954, suspicion long felt that the famous Piltdown jaw was anthropoid and did not belong to the skull which was alleged to have been found in the same area was confirmed by the finding that it had been artificially coated with mineral pigment, that its fluorine content differed considerably from that of the skull and that the grinding surfaces of the teeth had been artificially filed.[1]

cent of animal matter and 20 of water. Those taken from the plaster quarry contained the same quantity of water, but only 11 per cent of organic matter.

Identity from Articles of Clothing, Papers, Jewellery

The discovery of certain articles of clothing known to have belonged to a missing person in association with the bones of a skeleton will sometimes remove any doubts that may arise on the subject of identity. Metal buttons, brooches or rings are imperishable, and should be sought for by sifting or washing the earth.

In R. v. Platts, the prisoner was charged with the murder of a man named Collis. The deceased had not been seen alive since December 7th, 1845. On August 28th, 1846, some men, in cleaning out a cesspool in the neighbourhood, found some human bones with certain articles of clothing, which were supposed to be those of the missing man. With these remains there was the ordinary dress of a man—namely, coat, hat, trousers, neckerchief, and two garters, one red and one white. These were still around the bones of the legs. The bones were found to be those of a male human being, from 23 to 30 years of age. Fractures of the skull in the region of the forehead and left eyebrow gave evidence of foul play. The clothes were identified as those worn by the deceased at the time of his disappearance, and the white and red garters found round the leg-bones were identified by a woman who made them, and gave them to the deceased.

The prisoner was connected with the act of murder by a chain of circumstances. On December 7th he was seen with a hammer in his hand, quarrelling with the deceased. At a later period he was seen with two men pushing the deceased, who appeared to be in a stupefied state, into his shop. On the night following he was seen in company with two men carrying an apparently heavy sack in the direction of the cesspool in which the skeleton was afterwards found. The prisoner had made false statements respecting the transactions between himself and deceased, and the watch and boots of the deceased were traced to his possession. The deceased had been seen with the watch up to within half an hour of his disappearance.

For the defence it was contended that there was not sufficient proof in law that the remains found were really those of the missing man. The finding of some portions of the clothes of the man in the cesspool was not sufficient to prove the *corpus delicti*—the murder. There must be positive evidence that the remains were those of Collis. Patteson, J., overruled the objection, observing that the identity of the remains were altogether a question for the jury. The prisoner was convicted.

But for the discovery of the clothes, more particularly of the two different-coloured garters round the leg-bones, the identity in this case could not have been satisfactorily established. The suggestion that the deceased might have fallen into the cesspool by some accident was negatived by the fact that, had this occurred, the watch and boots would have been found with the remains, whereas these articles were traced to the possession of the prisoner. It is worthy of note that in this case the dead human body, in clothes, was reduced nearly to the state of a skeleton within the short period of nine months. This must be ascribed to the influence of the putrescent matters by which it was surrounded. Even if the body is putrefied, the clothing, or papers it contains, may give vital information.

In 1953, the police named as "wanted" for interview in connection with the murder of a woman in S.E. London a man called Pettit who had disappeared. Some six weeks later a surveyor, inspecting bombed City premises owing to a complaint of smell, found a maggot-ridden body curled up on its side, far too decomposed for direct identification. The clothing—a decisively check-patterned tweed jacket and grey trousers—was identified as Pettit's, and in it was found a dental appointment card bearing a number which gave access to hospital records of an extraction of a *8* for apical abscess in a man called Pettit some months previously. X-rays had been filed and the dental details corresponded exactly.

A drowned body, far too decomposed for recognition, was identified at a South-wark inquest in 1953 by the clothing, including a shirt marked L.254—a laundry mark used by a lodger in a South London boarding house from which a man had disappeared, a key in the jacket pocket which fitted the lodger's door. The general features—sex, age, height, hair—corresponded with those of the missing man.

Other points of circumstantial evidence also demand attention—the position of the bones when discovered in the ground, whether lying at full length or grouped together confusedly. In bodies which have undergone Christian burial, the skeleton is found lying at full length, usually with the head to the west and the feet to the east, and one skeleton may be found below another. These points may suggest that bones discovered during excavations or the foundations of new buildings are in fact from bodies interred in a burial ground. This inference is confirmed when the bones of persons of all ages and both sexes are found in or near the same spot.

In 1866, at Milcote, near Statford-on-Avon, two feet from the surface of the soil, upwards of two hundred human skeletons were found. They were placed closely side by side upon their backs, with their feet to the east and their heads to the west, and all were well preserved. There were young and old, and skeletons of both sexes, the bones presenting no marks of injury. This was no doubt the site of an ancient and long-forgotten burial-ground.

A man named Weekly Ball was charged with the murder of a woman named Lydia Atlee, with whom he had cohabited. While in the last stage of pregnancy, she had suddenly disappeared on July 22nd, 1850, and was never seen again. It was rumoured that she had been murdered, and the prisoner, who, it was alleged, had a strong motive for getting rid of her, was suspected of the act; but no legal proof could be obtained against him, and the matter dropped. On February 3rd, 1864, as a labourer was digging in a lane, by the side of a ditch near the village of Ringstead, in Northamptonshire, where the deceased and the accused had lived, he found a human skull and ultimately a skeleton lying at full length, face downwards about 20 inches below the surface. The skeleton, when laid out, was that of a middle-aged female, about 5 feet 2 inches in height. It had been in the earth from twelve to twenty years. The missing woman was far advanced in pregnancy, but *no fœtal bones* were found. In reference to this the surgeon stated that the bones of a fœtus contained more animal matter, and might have been decomposed, although he declined to swear that within the period of 14 years they would have entirely disappeared. No hair was found, although sought for, and no traces of clothes of any kind could be discovered. The ground was again searched for fœtal bones, and the result was that, about 18 inches deeper in the earth, the skeleton of a full-grown man was found, foot to foot with that of the female skeleton above, lying on its back; the bones appeared to have been much longer in the ground. On this discovery it was suggested that the spot might have been a gipsies' burial-place. It bore no connection with the disappearance of the woman Lydia Atlee.

Any object found with the bones must be carefully preserved and examined: it may form an important clue to identity—and sometimes also to the date of burial.

The reconstruction of human skeletal remains found during an archaeological excavation in Kent showed them to be of a girl of about 12 years. She appeared to have been seated at burial, and the remains of an iron chair decorated with bronze, found immediately under the bones, were sufficient to date the burial to about A.D. 600.[1]

Such matters may equally be of more immediate interest. In the Godalming "wigwam-girl" murder, the victim's body had been buried with heather at the time of commencing blooming, some six weeks previously.

CAN THE MANNER OF DEATH BE ESTABLISHED?

Indications of murder or violent death may be obtained long after the entire destruction of the soft parts.

[1] Jessup, R. F., 1955. *Archæologia Cartiana*, 68, 1.

Briand relates the case of a woman whose body was disinterred after eleven years' burial. It was believed and alleged that she had been murdered, and her body afterwards buried by her murderers. This was found completely reduced to a skeleton, but nevertheless the third, fourth, fifth, and sixth cervical vertebræ were still held together by a dark-coloured mass derived from the decomposition of the fleshy parts of the neck; and this mass was still surrounded by several folds of a cord, which had been employed as the means of strangulation. Proof was thereby obtained of the mode in which the murder had been perpetrated. A ring was found on the bones of one finger, which left no doubt whatever of the identity of the deceased.

In 1923, during reconstruction of a factory in Egypt, a collection of human bones forming a complete skeleton was found at the foot of a well. A bullet hole of entry lay in the top of the skull but there was no exit, and careful search of the remaining bones with the help of X-ray revealed the spent bullet lying buried in the manubrium of the sternum. It seemed likely that the victim had been shot whilst lying down, possibly during sleep, and then disposed of down the well. A suspect confessed to the crime which had, in fact been effected in this way.[1]

The case of Eugene Aram also furnishes an instance of the necessity for closely examining skeletons when it is suspected that the individuals have died from murderous violence. This man conspired with another to murder a person named Clarke who suddenly disappeared in February, 1745. In 1758—*i.e.*, thirteen years after his disappearance—some bones were accidentally discovered in a cave near the town where he lived. Aram's accomplice was arrested on suspicion; and, losing his presence of mind when charged with the murder, he declared that those were the bones, but mentioned the spot where the bones of Clarke were buried. A skeleton was there found, and a fracture and indentation of the temporal bone were plainly perceptible. The manner in which the murder was committed by the accomplice agreed with the medical evidence. Aram, who was a man of some ability, argued in his defence that it was impossible to identify a skeleton after a lapse of 13 years; that the fracture of the skull and the piece of bone beaten inwards proved nothing; that it might have lain long in the cave where it was found, which had been a hermitage, and therefore a likely place of sepulture in ancient times; and that the violence to the skull might have been produced in times of disorder, when in searching for treasure the graves and coffins of the dead were violated. In spite of the ingenuity of this defence, the facts were too strong against him, and he was convicted and executed.

Aram's defence gives an indication of the questions which are apt to arise when evidence is given from the examination of exhumed bones. Proof of identity is essential, and most careful examination of any fracture so as to enable a medical witness to determine whether it was recent or old, and whether it was likely to have been caused in life or during the exhumation must never be neglected.

In *R. v. Dougal*, what was known as the "Moat Farm mystery" excited very great interest. The facts were as follows: Dougal, who was a married man, persuaded a Miss Holland to live with him at the Moat Farm. It was proved in evidence by a servant that Miss Holland left the house with the prisoner one day in August, 1899, and was never again seen alive. Various excuses were made by the prisoner to account for her non-appearance. Meanwhile the prisoner proceeded to dispose of her property, and was arrested for forging the dead woman's name to a paltry cheque of a few pounds.

peculiarly small size, precisely corresponding to the size which deceased was known to have worn; they were of French make, and were distinctly identifiable; (4) the skeleton was that (a) of a woman, (b) of a person about the height of Miss Holland, (5) behind the position of the right ear was found a jagged fracture of the bone, with fragments carried inwards; the brain was sufficiently preserved for Professor Pepper who performed the autopsy, to trace a wound through it from behind forwards and to the left, at the anterior end of which wound was found a bullet. With regard to proving that the bullet was one which might have been fired by the prisoner, there was some little difficulty so long after the event, but there could be no doubt whatever that the person whose remains were found had been killed by a bullet fired from behind, and the circumstantial evidence was sufficient to prove (a) that the body was that of Miss Holland, and (b) that the prisoner was the only person who could have fired the shot, and (c) that he had opportunity and motive for doing so.

In reference to injuries found in skeletons, it is of great importance to attempt to determine whether the injury had occurred during life or during the exhumation, and if during life, whether it was recent or of old standing. This is difficult in cases in which the injury took place shortly before death. but if any attempt at healing has taken place this will still remain and will prove definitely that the fracture was of some standing.

In this connection it must be remembered that in the skull small portions of bone not infrequently ossify from irregular independent centres and remain for variable periods of time as small bones separable by maceration and disarticulation and known as ossa triquetra.   The aperture left by the separation of one of these bones may be mistaken for a fracture produced by a weapon, but the difference is usually well marked. If, on the one hand, the bone has not yet united with the others, the edges of the opening will be found quite thin and, as it were, bevelled off, and possibly membrane may be found on the edge. If, on the other hand, it has united, the then serrate suture or line of junction with the other bones can hardly be mistaken for the appearance of a fracture.

The dead body of a new-born child, wrapped in brown paper and a towel, was found in a pond. The head was much decomposed, and the scalp was extensively lacerated and destroyed over the parietal bones, which readily separated. The brain was fluid. Two apertures were present on one parietal bone; they were small and rounded, and it was at first doubtful whether they had not been wilfully produced by some perforating instrument. In one situation the scalp was entire and uninjured, but the other was situated under the lacerated portion of the scalp. No violence had been used in the removal of the body from the water. The bone was macerated, and carefully examined by the aid of a lens. The apertures were quite regular at the edges, which were remarkably thin, evidently merging into a membranous condition. This examination left no doubt that the holes in the bone were not due to any mechanical violence but to deficient ossification. The spaces had been membranous, and the membrane destroyed by decomposition.

made to dispose of the body by burning. This method of disposing of a dead body is by no means unusual in cases of alleged infanticide and concealment of birth. There is little difficulty in deciding whether a bone has or has not undergone calcination. Its character is entirely altered. Its shape may be preserved, but if burnt in the open air, it will be white; if in a closed fire, it will be black or ash-grey. The bone is brittle, easily pulverizable, and dissolves in hydrochloric acid, leaving, if perfectly calcined, only some charcoal, but no animal matter.

In *R. v. Varney*, the accused had been delivered of a child, whose body had been burnt, and only a few remains of the bones of a human fœtus were found in the ashes of a grate. The accused was convicted of concealment of birth.

In a case like this, in which an attempt had been made to destroy the body of a child by burning, it will, of course, be necessary to have good evidence that the bones are those of a human fœtus, or child. A small fragment of either end of any well-marked bone will suffice for identification. If the jaws are present the number and condition of the teeth should be noted. The period of uterine life which the child had attained may be roughly determined, as also by the presence or absence of ossification centres (see p. 131).

If the body has been burnt to a complete ash or powder, it will of course be impossible to identify the bones.

When the *form* of a bone cannot be recognized, all that medical evidence can accomplish may be thus stated: The detection of a large quantity of *phosphate of calcium* in the ash would suggest that bones were present, and thus distinguish the ash of bone from the ashes of other substances. The bones might nevertheless have belonged to an animal, and not to a human fœtus. There are no accurate means of distinguishing the ash of human from that of animal bone, or the ash of fœtal from the ash of adult bones. The precipitin test does not operate with bone ash.

In the case of the Lemoines, mother and daughter, tried before the French courts in 1859, the evidence went to show that the elder prisoner (the mother) burned the body of a child of which her daughter had been secretly delivered. Some bones of a child were recovered, and amongst others the frontal bone. The medical evidence was to the effect that the bones were those of a child which had reached about the seventh or eighth month. Upon this corroboration the jury convicted the elder prisoner.

temperature, which had destroyed their internal structure, but the external form was well preserved. They were all human bones. A chemical and microscopical examination of some of the clinkers showed that there was blood upon them, having the character of human blood. There seemed no reasonable doubt that these were the remains of the missing man. He was last seen alive at eight in the evening, and at four the following morning nothing else remained of him.

Vide also the case of Dr. Parkman (p. 139).

CHAPTER V

DEATH AND POST-MORTEM CHANGES

THE conditions that give proof of death and the changes that ensue in the dead body will be discussed in the following order:—

Immediate—*infra*

Insensibility and loss of power to move ⎫
Cessation of circulation ⎬ Somatic death
Cessation of respiration ⎭

Early—p. 166

Molecular (cellular) death.
Cooling
Skin changes
Eye changes
Blood changes—Hypotasis
          Fibrinolysis
          Post-mortem bleeding
Cerebro-spinal fluid changes
Muscular changes—Rigor mortis
           Freezing
           Heat coagulation
           Cadaveric spasms

Late—p. 186

Putrefaction—in air
          in water
          in earth
Adipocere formation
Mummification

IMMEDIATE SIGNS OF DEATH AND POST-MORTEM CHANGES

witnessed in prolonged fainting attacks, vagal inhibitory phenomena, in epilepsy, trance and catalepsy, in narcosis, in electrocution, and during the therapeutic use of muscle relaxants such as curare; in fact these two signs of death have by the laity had a very undue weight thrown upon them without attention being paid to other more certain signs.

Cessation of Circulation

The cessation of this important function is often regarded as in itself sufficient to determine the reality of death, and rightly so if the observation be made with sufficient accuracy by the stethoscope and over a sufficiently prolonged period.

In 1950 one of the authors was at work in a London mortuary when the body of a woman aged 75 was brought in, stripped and laid on the table for autopsy. She had been found cold and apparently lifeless, lying on a common some 20 minutes previously: a doctor had, on her arrival at hospital, got into the ambulance, placed a hand on the chest, found it cold and had felt no pulse, pronouncing her dead. Some four or five minutes after she had been placed on the mortuary table she was seen to swallow twice: she was found to be breathing and to have heart beats. She died of coronary thrombosis and myocardial infarction 2½ hours later.

That the heart may beat with undiminished vigour up to the last beat, Dr. F. J. Smith was convinced by what he believed to be an almost unique experience

He was engaged in counting the heart-beats of a pneumonic patient, and had counted some ten or eleven sounds, and was thinking how good and satisfactory they were, but no twelfth sound was heard. The patient had actually *died at the moment of listening. Per contra* he had also listened as the sounds grew feebler and less frequent, while the patient fainted and fell back on the bed apparently lifeless, to return in a few seconds as the faintness passed away.

Life is not incompatible with a temporary suspension of heart-beat, but it is undeniable that the function must be speedily re-established or death is certain. The limit of tolerance of suspension of heart action will vary with the degree of oxygenation of the blood at the time of the suspension, on the general metabolic rate, and on the body temperature. During operations which are undertaken when the body temperature has been artificially lowered (hypothermia) the tolerance is increased.

Certain brain cells are especially susceptible to deprivation of oxygen and even if death does not occur they may be permanently damaged. *Under normal circumstances longer than 3–5 minutes cessation of heart beat is incompatible with life.*

The phenomena of hibernation in many animals can have no reference to this condition, for in these a purpose is answered by the feeble state of existence into which they are thrown. It is natural for such animals to remain torpid during the winter season, or to exist under a feeble exercise of the functions of respiration and circulation, but it would be an unnatural condition for a human being, and inconsistent with the maintenance of life. The auscultatory test, applied at intervals during half an hour, cannot fail to lead to a satisfactory conclusion. Taylor's statement of Bouchut's observations remains apposite:

Bouchut found, in an extensive series of researches experimentally confirmed, that in all cases of apparent death, whether arising from asphyxia or syncope, there is one common character by which they may be distinguished from real death, and that is a continuance of the pulsations of the heart. He established the fact that in the most perfect state of syncope, attended with entire loss of motion and

sensation, the contractions of the heart were not really at any time suspended, but simply reduced in force and frequency. In syncope from hæmorrhage carried to the fullest extent, and in cases in which respiration was either imperceptible or carried on at long intervals, the body at the same time having the aspect of a corpse, he was enabled by auscultation to detect the pulsations of the heart, and thus to distinguish apparent from real death. In children born in a state of apparent death and in cases of asphyxia from any cause, in narcotic poisoning, in hysterical and epileptic coma, and in all diseases which have been stated to resemble apparent death, the living has been easily distinguished from the dead body by the continuance of the heart's action. This was feeble, and took place at intervals, but it was always sufficiently marked to enable a professional man to distinguish a living from a dead body.

It is important to define, if possible, the periods at which, after the entire cessation of the heart's action, a person might be pronounced dead. The highest degree of bradycardia (or slow-beating heart) recorded is ten or twelve beats per minute. If, therefore, no sound of the heart is perceived during an interval of three to five minutes, a period which is usually many times as great as that which observation warrants, death may be regarded as certain.

This test has been objected to (1) because in certain suspensions of normal rhythm the heart itself may, like other muscles, be in a state of apparent, and not real, death, and (2) because the pulsations and sounds of this organ may not always be appreciable to the ear, even when aided by the stethoscope. Further, ventricular (as distinct from auricular) fibrillation, though recognizable as muscle contracture, does not provide a circulation.

In support of these objects, the vitality of new-born children is commonly restored when no pulsation whatever could be discovered for a period of ten to fifteen minutes after birth. In one instance a child was revived, after 20 minutes of apparent death, by insufflation of the lungs, although during that time no pulsation could be heard or felt. Numerous cases of resuscitation by massage of the heart and by other means after the heart has stopped beating have been recorded.[1] Temporary stoppage during anæsthesia is common.

Another test, which should only be resorted to in extreme cases, involves opening a small artery. When this is opened the character of the blood flow must be noted. It should be pulsatile if the heart is still beating; continuous, like the flow from a vein, if the heart has ceased and the bleeding is merely passive.

any current after a period of three minutes, it must be assumed that death has occurred. This method though superior to the methods described above, is obviously not practicable in most of the cases which come before the practitioner.

Cessation of Respiration

This, like the cessation of the heart-beat, must be complete and continuous to constitute any approximation to a test of the reality of death. It may cease for a very short period without death ensuing in the following conditions, none of which is likely, however, to give rise to any difficulty in connection with real or apparent death:—(a) As a purely voluntary act. Two minutes seems here to be the outside limit, which experience shows cannot be exceeded; even expert sponge-divers, who have spent their lives at the occupation, cannot remain under water without artificial contrivances for a longer time than two minutes. (b) In the peculiar condition of respiration known as Cheyne-Stokes breathing the limit of the apnoeic interval has never been known to exceed some 15 to 20 seconds. In (c) the apparently drowned and (d) new-born infants, the act of respiration is frequently absent for long periods, and doubts often occur as to whether life really remains in the body. It is quite possible that in some of both classes suspended animation passes into real death owing to the want of perseverance in artificial aids to establish natural breathing, but the subject is more fully discussed elsewhere (p. 204 and Section on "Drowning"). After electric shocks there may be every appearance of death, but continuous artificial respiration may cause natural breathing to commence after long periods. It has not very much bearing on the reality of death in such cases as are here under discussion, in which it may be laid down that some two minutes is the extreme limit during which respiration may cease and yet life be maintained. This does not, of course, take into consideration the special conditions under which an anæsthetist may artificially maintain some useful kind of ventilation of the lung.

Tests for Breathing. (1) The movements of respiration can hardly be overlooked by any person who exercises due care, but for the purpose it is necessary to have both the chest and the abdomen exposed to view. (2) The stethoscope must be carefully and continuously applied to the upper part of the lungs in front or to the larynx itself, by which means very slight currents of air may be detected. This test alone is practically sufficient, but if doubt still remains (3) a feather may be held in front of the mouth, when even the slightest breath may move some of the smallest divisions of it, or (4) a piece of cold, bright looking-glass may be held there, the surface of which will be dimmed by the moisture deposited upon it from the breath if even the slightest respiration is continuing. (5) A glass of mercury or other bright reflecting surface may be placed on the chest or epigastrium and the reflection of a light from it be focussed on a fixed spot. This image will be seen to move if respiratory movements of the slightest degree are still continuing.

EARLY SIGNS OF DEATH AND POST-MORTEM CHANGES

Molecular Death

After somatic death certain tissues and cells in the body continue to live individually or collectively for a period of time depending to some extent on the cause of death, the condition of the cells or tissues before death, and their oxygen requirements. For instance. for periods up to as long as two

hours voluntary muscles may be made to contract by mechanical or electrical stimulation. That the heart continues to beat or contract for a while after certain forms of violent death, e.g., decapitation, is well-known. In the past these *post-mortem* muscle contractions have been mistaken for vital movements, and in cases where these have occurred after rapid interment and subsequent exhumation, changes in the position of the limbs have been assumed mistakenly to indicate premature burial. Portions of gut removed at operation, or immediately after death, retain their power of contraction when stimulated either mechanically or by drugs or toxins. The pupil will react for varying periods to certain drugs.

Nystem concluded from his observations that the successive disappearance of muscular irritability in the bodies of decapitated persons took place in the following order: (1) the left ventricle of the heart, (2) the stomach and intestines, (3) the urinary bladder, (4) the right ventricle, (5) the œsophagus, (6) the iris, and (7) the voluntary muscles of the body.

Cooling of the Body

When life is extinguished, the body gradually loses the heat which it possessed at the moment of death, just as might so much inert matter artificially raised to the same temperature.

The usual temperature of a healthy adult at rest is approximately 98·4°F (37°C) when taken by the mouth, whereas the temperature of the rectum at the same time and under the same conditions is about 99°F and in the axilla about 97°F. None of these temperatures is constant and there are individual and daily variations up to 1–1·5°. The temperature varies according to the time of day and will be lowest in the morning between 2 and 6 a.m. and highest in the afternoon at 4 to 6 p.m. Mild exercise may cause a slight rise and heavy exercise a rise of greater extent which however drops to normal in 20–30 minutes.

Of all the changes that occur in a dead body, that of cooling to the temperature of its surroundings was the first to be clearly understood. The rate of loss of heat from a cadaver obeys recognized physical laws, and because of this cooling of a body offers one of the most reliable methods of estimating the time which has elapsed since death up to a period of about 24 hours.

Although the rate of heat loss can thus theoretically be precisely defined there are a great many variables to consider in connection with conduction, convection and radiation; these factors have to be taken into account and the importance of any one of them can only be accurately assessed after considerable practical experience.

In order to understand the process of cooling it is first necessary to give a brief outline of the mechanisms by which the normal body temperature is maintained at a constant level in life. Under certain circumstances these mechanisms may be upset by the mode of death, and the temperature at the time of death is accordingly raised or lowered, and unless this is accounted for, erroneous results will be obtained when estimating the time of death from the rate of cooling. It is not proposed to discuss these mechanisms in great detail as they may be explored fully in any of the standard textbooks on physiology.

substances with the production of heat. The process is taking place continually throughout life and occurs in all tissues and organs of the body. Most of these oxidation processes take place in the muscles and the liver. The process is slowed to a minimum during sleep or rest, but is considerably accelerated during physical exercise. The heat liberated by these metabolic processes in the muscles and the internal organs is distributed round the body by means of the blood circulation.

Loss of heat from the living body. Heat is lost from the body mainly from the skin and lungs. Approximately 15 per cent is lost from the lungs, 80 per cent is lost from the skin by radiation, convection and evaporation, and some 5 per cent is lost by warming cool inspired air and ingested food and water.

The heat-regulating mechanism in the living body. The temperature of the living healthy body is maintained at a constant level by the heat-regulating centre, which is situated in the brain in the floor of the third ventricle. This heat-regulating centre controls the body temperature mainly by increasing or decreasing the general metabolic rate, and by increasing or decreasing the blood flow through the skin and the production of sweat.

Under a variety of circumstances the heat-regulating centre may raise the body temperature and maintain it at a higher level than normal, as occurs in a febrile illness. Under certain conditions the heat-regulating mechanism may be so stimulated that it causes excessively high temperature (hyperpyrexia) from which recovery is impossible. Under other conditions the heat-regulating mechanism may be unable to exert its normal control; for instance, in severe dehydration (when there is no sweat available for evaporation), after an injection of curare, or in certain spinal injuries where the nervous pathways have been paralysed or severed. Occasionally it is so overwhelmed by certain phenomena, such as heat-stroke and virulent bacterial infections, that it loses control altogether.

The majority of factors which upset the action of the heat-regulating centre occur in natural pathological conditions such as the severe bacterial or protozoal infections already mentioned, and in natural intra-cranial hæmorrhage where the centre is stimulated.

The body temperature may sometimes be above normal at the time of death. For example, in deaths from violence, especially if there has been a struggle, and also sometimes in death from asphyxia as in suffocation. It may also be raised when death is due to head injuries involving the regulating centre.

After deaths in which the body temperature has been raised at the time of death, the cooling of the body still obeys the same physical laws which apply to a person dying at a normal temperature, but as the initial temperature at the time of death was above normal, this possible elevation in temperature must be allowed for in the estimation of the time of death. We are not justified, however, in assuming as a fact that any body which we are examining did have a temperature above normal at the time of death, though this is, in fact, common.

In considering the rate of cooling we must also bear in mind that the cooling in the first hour after death may be relatively slow for as long as there is oxidizable carbohydrate in the blood the residual oxygen present may continue the oxidation process and evolve heat.

In *R. v. Heath* (C.C.C., 1946) the nude body of a girl was found bound, (recently) gagged and dead of asphyxia, in a Notting Hill Gate hotel. The rectal temperature

at 6.30 p.m. on the day the body was found was 84°F (room 63°F). It was assumed by the investigating authority that the murder had taken place around midnight the previous night for Heath had, arrived at the hotel with the girl at about 12.15 a.m.—and was heard to slam a door (in leaving) at about 1.30 a.m. If the temperature of the body at the moment of death was 98·4°F it would mean that the body temperature had fallen only 14·4° in about eighteen hours. The body though in a closed room was naked and in this case it appeared reasonable to assume that the initial temperature was raised above the normal by the act of strangulation.

In *R. v. McKinstry* (C.C.C., 1942) a girl's body had been found at 8.30 a.m. on the foreshore of the Thames under a parapet of the newly constructed Waterloo Bridge. A police surgeon certified death and (after placing a hand on the body) expressed the view that death had occurred four to seven days previously. In fact, on autopsy at the mortuary at 12.30 p.m., a rectal temperature of 47°F was measured (air 38°F, Thames river 31°F). McKinstry was seen to leave a local public house with Peggy Richards, the murdered girl, at 11 p.m. and to walk towards the (then) deserted Waterloo Bridge, and it was assumed that the murder occurred about midnight the previous night. In this case, if the initial temperature is placed at 98·4° it would mean that 51·4° of temperature were lost in about 12–13 hours, that is about four degrees per hour, which in view of the fact that the river water was below freezing point is not specially rapid.

In a case brought into Guy's Hospital at 8.10 a.m. following a vehicular street accident where a bus had knocked down and pinned a cyclist beneath the chassis, pronounced traumatic asphyxial changes were present. The temperature at autopsy five hours later was still 99°F. The casualty officer had been given a temperature of 106·4 by the nurse who made routine observations of pulse, temperature and respirations on admission at 8.15 a.m.

In certain cases the recorded temperature may continue to rise after death for a period of an hour or two. This occurs in certain severe bacterial infections, and after hæmorrhages into the brain stem.

Increase of temperature after death has been referred to under putrefaction; but it can occur soon after death, and before rigidity sets in. Some of the cases reported by Wilks and Taylor also show that it may take place independently of putrefaction. Dowler has noticed it as a common occurrence, in a warm climate, in the bodies of persons who have died from yellow fever. When the maximum, which is variable in different bodies, has been attained, the body gradually undergoes the cooling process observed after death. In a death from epidemic cholera the dead body reached its maximum temperature of 109°F. in about an hour and a half. These observations may serve to explain that in some exceptional instances a dead body may retain for many hours a temperature as high as or higher than, that which is usually found in the living.

A caution must be here inserted with regard to the exact meaning of the cooling of the body, and how it is to be determined. It is not enough to judge of the coldness by placing the hand on the skin: this is highly fallacious, inasmuch as it depends, first of all, upon the warmth of the observer's hand—a corpse may feel cold to a warm hand and warm to a cold one; and, secondly, the temperature of the skin of a corpse is no criterion of the internal temperature.

should in all cases be introduced into the rectum or through a puncture in the abdominal wall into the cavity of the abdomen, and the temperature should be read whilst the instrument is *in situ*. *Readings should be made at intervals* in order to obtain the *rate* of fall of temperature. Under no circumstances should the temperature be taken in the vagina in cases of suspected foul play.

With this caution we are now in a position to appreciate the factors which are likely to influence the cooling of the body. The principal factors involved are:—

The difference in temperature between the body and the medium in which it is lying. This is a simple physical phenomenon. The dead body behaves as any other inert mass possessing heat and will lose heat until it reaches the temperature of its environment obeying Newton's laws of cooling. The rate of cooling is proportional to the difference in temperature between the body and its surroundings, and the greater the difference between these the more rapid will be the rate of cooling. The rate of cooling gradually slows as the temperature of the body approximates to that of its environment. A naked body of average physique in air will cool to the temperature of the air in about 20–30 hours, according to the environmental level.

In *R. v. Smith* (Lewes Assizes, 1946) a body found lying in the snow in a yard at Hastings at 9.30 a.m. was left covered by a tarpaulin until the arrival of the investigating team at 6 p.m. The rectal temperature was still 55°F.—though the man had been shot, it was subsequently proved by evidence in statements, somewhere between 6 and 8 p.m. the previous night. Death could not have taken place as long as 20 to 22 hours previously, *for the rate of fall could hardly have been as little as* 2° per hour average during this period of exposure overnight in the snow. The air temperature during the day had been 32° to 36°. The explanation lay in the nature of the wounds which were such that death would be likely to be delayed several hours: the extravasation of blood confirmed this. *The time of injury is not necessarily the time of death.*

The build of the cadaver. The relationship of mass to surface area. A recently dead body in common with any inert object at a higher temperature than its surroundings possesses a quantity of heat which must be lost before it reaches the temperature of its environment.

The rate of loss of heat is proportional to the weight of the body to its surface area; thus *children and adults of small stature will cool more rapidly* than the average adult although their actual heat loss per unit of time *will* be less over the same ranges of temperature.

The physique of the deceased. Fat is a bad conductor of heat, and therefore the greater the quantity and the more general the distribution of the body fat, the slower will be the rate of cooling. Young women normally have more subcutaneous fat than young males and there is a tendency therefore for the bodies of young women to cool more slowly than the bodies of young men of similar age, weight and build. A thin or emaciated person, on the other hand, will cool more rapidly owing to the absence of this subcutaneous fatty layer.

The environment of the body. The environment of the body exercises a profound influence on the rate of cooling and this influence depends not only on the nature of the medium but also on its volume and movement. A body in air loses heat by convection and radiation; some, however, will be lost by conduction through the material on which the body is lying.

Anything which will increase the rate of radiation, conduction, or convection will accelerate cooling. Thus a body lying exposed in a well ventilated room will cool more rapidly than one in a sealed room, as the freely circulating air will rapidly carry away the air warmed by the body. A body placed on a metal slab will lose heat more rapidly by conduction than one placed on a porcelain slab. A body lying snugly in bed or sealed in a coffin will lose heat much more slowly than one lying on top of the bed or in a sealed room, owing to the smaller volume of air present around the body and the lack of movement in the air.

A naked body immersed in cold water loses heat largely by convection and conduction, conduction playing much the more important role. A body so immersed cools at about twice the rate of a body exposed to air, and movement of the water will tend to accelerate cooling by carrying away more rapidly the water warmed by the body. It must not be forgotten that bodies found dead in baths may have become warmed thereby after death.

Bodies buried in earth will usually cool more rapidly than those in air but more slowly than those in water. However, this is by no means a general rule, much depending on the conducting properties of the soil; a body, for instance, buried in dry soil will retain its heat far longer than a similar body exposed to air. If a body is buried in rotting material such as a dung-heap the body temperature will rise or fall to that of the dung-heap. The various factors which influence the cooling of the body in earth will be more fully discussed in a later section.

Coverings on or around the body. Clothing on a body, or bedclothes around it, substantially retard the rate of cooling irrespective of the medium in which the body is lying. Generally speaking clothing is a bad conductor of heat, the conducting properties depending to some extent on the nature of the clothing, e.g., wool, cotton or silk, but to a greater extent on its texture. The more minute air spaces within the clothing itself, the poorer will be its conducting properties, and the slower the rate of cooling.

The greater the number of layers of clothing within certain limits, the slower the rate of cooling.

In air, water and earth, the delay in cooling is due to the slow conduction of the body heat through the clothing. Once the heat reaches the outside medium through the external layers of clothing it is then dissipated by convection, radiation and conduction.

It is not uncommon for relatives to place hot-water-bottles in the beds of persons who die at home. Under these circumstances the body temperature may remain raised for a considerable period, and the more advanced states of decomposition to be described later may present themselves after a period of only a few hours.

It has been alleged that in death from hæmorrhage the *rate* of cooling is accelerated owing to the loss of blood. This has no foundation in fact; the only physical difference created is that some heat has been lost in the extravasated blood, and though there is a reduction in the total amount of heat in the body no difference occurs in the temperature.

to rapid cooling; it was placed in a shell with a shirt loosely over it, and the temperature of the mortuary was 38°F.

Cooling of the body is the most important single phenomenon in the estimation of the time of death and every factor in connection therewith must be recorded and carefully considered. In all cases the rectal temperature of the body must be recorded and also the temperature of the medium in which the body is found, *repeating the observations at intervals* in order to arrive at some estimate of the *rate* of change over a period of several hours.

It is obvious that when we have to consider so many variables it is quite impossible to devise an accurate formula to define the rate of heat loss. In temperate climates it has been suggested that for an average adult the overall heat loss in air may average 1·5°F. per hour, and in tropical climates about 0·75°F. Such figures have to be used with great circumspection and looked upon merely as a broad generalization.

In the case of *R. v. Whiteway* (C.C.C., 1953) two girls were murdered on the Teddington Towpath and thrown into the river. The first body was recovered the next morning and the rectal temperature at that time 68°F. The mortuary temperature was 60°F. and the average water temperature of the Thames during the preceding 24 hours was 64°F. It was estimated, bearing in mind the period of immersion in water and of cooling after recovery, that some 2½ to 3½ degrees would have been an approximate rate of fall in temperature during the period of hours immediately following death. This gave the estimated time of death as somewhere between 9 p.m. on the previous night and 2 a.m. on the morning the body was found. This wide limit was later shown to embrace pretty squarely the time (11.30 p.m.) when the crime had been committed.

It might be argued that such a wide range is of little use when the police are seeking accuracy, but to set closer limits can only expose the pathologist to severe and damaging cross-examination and is unwise. This estimate of the time of death may however be of the utmost value to the police in their investigations and though it is subject to so many variables should always be attempted.

Changes in the Skin

After death the skin may be observed to become pallid and waxy-looking, owing to the failure of peripheral circulation. In some parts as the body cools it becomes covered by livid discolorations (cadaveric hypostases). One of the most striking changes in the skin is its loss of elasticity. In the living body, if any part of the surface be compressed, the skin will gradually return to its original form on removing the pressure. Thus in a doubtful case, a flatness of those parts which have been allowed to lie upon an even surface may be regarded as a minor sign of *real* death.

Another condition of the skin of the dead which calls for notice is its opacity. If the hand of a living person is held before a strong light, it will be found to be translucent and of a deep red colour, the translucency of the tissues allowing of the red colour of the circulating blood to be seen through the skin. The hand of a dead person is virtually opaque owing to the opacity of the skin. In applying this test, we must remember that a horny or hardened state of the cuticle, or a diseased condition of parts, may interfere with the translucency in the living subject; it is always better seen in the young and of course in those whose hands are thin and delicate.

In the living, light thus passing through the skin will actually display the spectroscopic appearances of blood if passed through a spectroscope. Such a test fails if attempted with a dead body.

Eye Changes.

(a) *Loss of corneal reflex.* This is found in all forms of deep insensibility, e.g., general anæsthesia, apoplexy, uræmia, epilepsy, narcotic poisoning. It is also lost after cocaine or other local anæsthesias and cannot be considered to be a reliable sign of death.

(b) *Clouding of the cornea.* This affords stronger presumption of death, but as it may occur in certain diseases, such as cholera and other wasting conditions, before life is extinct, it is therefore unreliable.

The speed with which the cornea becomes opaque after death is due to desiccation, and is retarded if the lids are closed after death. If the cornea is kept moist with saline, it will remain transparent enough to allow examination of the fundus for two hours or longer after death. If, however, the eyelids remain open the cornea may become opaque so rapidly as to prevent examination of the fundus within a few minutes.

On exposure to air for a few hours after death the cornea develops a film of cell debris and mucus upon which dust steadily settles, and later on the the corneal surface becomes wrinkled and brown.

(c) *Flaccidity of the eyeball.* The intra-ocular tension falls rapidly after death, and the eyeballs tend to sink into the orbital fossa. This flaccidity is readily appreciated by simple palpation.

(d) *State of the pupil.* The iris contains a large proportion of muscular tissue which during life enjoys, in common with all muscles, certain "tone". This "tone" is rapidly lost after death and the iris relaxes into a condition of equilibrium. After a time the iris will contract slowly with the onset of rigor mortis. The power to react to light is soon lost after death, but it must not be forgotten that it may already have been lost during life.

The action of drugs—atropine, eserine—continues usually for a period of an hour or somewhat longer after death. Their application to an eye under such circumstances is free from all risk, and may therefore be made when this form of evidence might be required to confirm the reality of death.

No conclusion can be drawn from the size of the pupils in death as to the diameter which they presented at the latest period of life. This is of some practical importance in reference to the *post-mortem* appearances in cases of alleged narcotic poisoning.

During life it is not possible to press the pupil out of its normal circular shape but, within a few moments of death, pressure on either side of the eyeball causes the pupil to become irregular.

(e) *Changes of colour in the fundus.* Immediately after death the optic disc becomes pale and has the appearance of extreme optic atrophy. The remainder of the fundus gradually changes colour, taking on a yellow tinge which later changes to a brownish-grey or slate. After an hour or so the retina becomes almost as pallid as the optic disc.

(f) *Changes in the retinal vessels.* After death the bloodstream in the retinal vessels rapidly becomes segmented. This change appears within minutes after death, and persists for an hour or so, after which the vessels are so contracted that they are difficult to observe through an ophthalmoscope.

Post-mortem Hypostases

The phenomenon of *post-mortem* hypostasis or lividity is due to the fact that while the blood is liquid it obeys the universal law of gravitation and sinks to the lowest available part; furthermore the heavier parts of the blood—viz., the red corpuscles—have a tendency to settle first. This is a

point of some importance in deciding the position in which a body has
lain during the hours succeeding death. The phenomenon of hypostasis
as seen by the naked eye consists in the appearance in the skin of the
body of discoloured patches—slatey blue or reddish purple in early stages,
varying to bright red or coppery, or even green, when decomposition has
advanced—to which many different names have been applied (post-mortem
hypostases, subcutaneous hypostases, cadaveric lividities, suggilations,
vibices, post-mortem stains). Of these names post-mortem hypostases or simple
hypostases is the best, founded as it is on the basis of the universally accepted
theory as to the method by which they are produced. These appearances
have sometimes been mistaken for the effects of violence applied during life,
and serious mistakes have thus arisen. Innocent persons have been accused
of violence, and have been tried on charges afterwards proved to be groundless.
Christison refers to two cases, in one of which two persons were convicted, and
in the other three narrowly escaped conviction, upon a mistake of this kind.

Hypostases generally commence to form within a few hours of death. If
death has been taking place slowly over a period, early hypostases may be
present before death has actually occurred. At first hypostases form patchy
or mottled areas, but within about 12 hours they are complete in their
permanent form by coalescence of the smaller areas.

Hypostasis occurs in all deaths provided the body remains largely intact.
In deaths from profound anæmia or hæmorrhage the hypostases may be
barely discernible. If the body is constantly moving its position, as after
drowning in moving water, the change may never develop. It is important
to remember that hypostases occur in the viscera as well as in the skin; a
condition which is liable to be mistaken for congestion occurring during life,
or attributed to some pathological condition responsible for death.

One of the authors was called to Watford to examine the body of a man suspected
to have been poisoned by his wife, with whom he was on bad terms. He had died
suddenly after taking an evening meal prepared by her and the plum-coloured
reddening of the loops of small bowel suggested to the local pathologist that a poison
had been taken. The colour was undoubtedly due to hypostasis and further dissec-
tion of the coronary vessels revealed a fresh coronary thrombosis. Analysis, made
for the sake of security, proved entirely negative.

Hypostases may be found in the veins of the pia mater in the posterior
fossa of the skull, where they may be mistaken as a sign of asphyxia or of
meningitis. From the former it is very difficult to distinguish them except
by the fact that if the congestion be due to asphyxia it is likely to cause
actual turgidity of the veins and to be equally well marked over the hemi-
spheres in the middle and anterior fossæ as well as the posterior. In hypo-
stasis there will be no observable turgidity, and the condition of fullness will
be in the lowest fossa posterior in the usual supine position of a corpse,
anterior in a prone position. From the latter they are easy to distinguish
by the absence in hypostasis of any pus or sticky serum: in inflammation
one or both of these will be usually noticeable; moreover, in simple hypostasis
the pia mater will have a clear glistening appearance which will be absent if
inflammation has been present. Congestion without inflammation and simple
hypostasis may be confused by one who is unaccustomed to making autopsies.

During life congestion may be of two kinds: (1) active or arterio-capillary-
venous, which is the visible indication of inflammation, or of blushing or
flushing; (2) passive, which is due to a mere overfilling of veins, either from
want of a suction power in front or a driving power behind. After death the

signs of active congestion are likely to diminish, and those of passive or simple filling of veins to increase; and it is the latter which are so difficult to distinguish from inflammation in certain viscera.

In the dependant parts of the lung hypostasis is liable to be mistaken for the early stages of pneumonia. The diminished resistance offered to penetration of the finger through the substance of the lung is suggestive, but it must be admitted that it is not always easy even after much experience to discriminate between a mere hypostasis and a condition due to active ante-mortem hyperæmia, especially if the latter be combined, as it so often is, with an escape of blood out of the capillaries. Caution must be exercised in expressing an opinion in a case that is doubtful, and the absence of other distinguishing features, such as a similar condition in non-dependant parts: definite valvular disease of the heart, or definite bronchitis may provide assistance. The most intense passive congestion of the lungs is seen in many cases of brain disease. Microscopic examination should be made in any case where there is the least doubt of the pathological condition.

In dependent parts of the stomach and intestines hypostasis is liable to be mistaken for inflammation. In the absence of definite lymph on the peritoneal surface, or pus, or actual hæmorrhage, the best distinguishing feature lies in the fact that on stretching the viscus the continuous black lines (the veins filled with blood) will break up into isolated lengths, with gaps between them if the condition is due to hypostasis; they will remain unbroken if inflammation is present.

Hypostases may resemble Marks of Violence (Bruises). This is true on a superficial examination, but there are many definite points of distinction, which may be tabulated thus:—

Bruise	Hypostasis
1. Below the epidermis in the true skin in small bruises or extravasations, below this in larger ones, and often much deeper still. The reason is obvious, viz., that the epidermis has no blood-vessels to be ruptured	1. In the epidermis or in the cutis, as a simple stain or a showing through the epidermis of underlying engorged capillaries.
2. Cuticle probably abraded by the same violence that produced the bruise. In small punctures, such as flea bites, this is not observed.	2. Cuticle unabraded, because the hypostasis is a mere sinking of the blood; there is no trauma.
3. A bruise appears at the seat of and surrounding the injury. This may or may not be a dependent part.	3. Always in a part which for the time of formation is dependent, i.e., at a place where gravity ordains it.
4. Often elevated, because the extravasated blood and subsequent inflammation swell the tissues.	4. Not elevated, because either the blood is still in the vessels or, at most, has simply soaked into and stained the tissues.
5. Incision shows blood outside the vessels. This is the most certain test of difference, and can be observed even in very small bruises.	5. Incision shows the blood still in its vessels; and if any oozing occurs drops can be seen issuing from the cut mouths of the vessels.

6. Colour variegated. This is only true of bruises that are some days old; it is due to the changes in the hæmoglobin produced during life.

6. Colour uniform. The well-known change of colour (green, yellow, etc.) produced in blood extravasated into living tissues does not occur in dead tissues with the same regularity.

7. If the body happens to be constricted at, or supported on, a bruised place, the actual surface of contact may be a little lighter than the rest of the bruise, but will not be white.

7. In a place which would otherwise be the seat of a hypostasis pressure of any kind even simple support (the wrinkling of a shirt or necktie, garters, etc.) is sufficient to obliterate the lumen of venules and capillaries, and so to prevent their filling with blood; white lines or patches of pressure bordered by the dark colour of a hypostasis are produced and marks of flogging, strangulation, etc., are thus sometimes simulated.

Sections of the part should be prepared in any case of doubt and microscopic examination should make the diagnosis certain.

A body recovered from the River Thames was found to have striking engorgement of the head above a linear constricting mark set around the neck at about mid-thyroid level. Suspicion of strangling arose, and the finding of a number of plum-coloured hæmorrhagic areas in the soft tissues of the neck along the upper level of this—and of protrusion of the tongue between the teeth—heightened this. It was plain, however, that the intensity of engorgement and the deep-seated petechiæ were due to tight constriction by the collar (which had been removed upon recovery of the body). The head, hanging low in water, had acquired the more pronounced lividity common to cases of immersion.

These points are sufficient, if carefully noted, to decide whether a given mark was due to violence or not; but it must be admitted that feebleness of circulation in the aged, and sometimes the effect of exposure to cold, may resemble the effects of violence. Such marks are, however, practically always found on parts, such as the ear, the shins, the fingers, or toes, where the circulation is comparatively poor.

When decomposition commences the blood shares in the process, and hypostases undergo some changes in consequence; they may change in colour to coppery red, to light or olive green; and since the blood gradually lyses it permeates the tissues causing a general discoloration throughout. Hence it follows that as putrefaction advances it becomes progressively more difficult to distinguish between a bruise and a hypostasis, for the crucial test of finding blood actually effused from the vessels into the tissues becomes more difficult of appreciation. The difficulty with the other corroborative tests is perhaps more academic than practical, but it is nevertheless well to exercise caution in giving an opinion when the body is much decomposed.

For the importance of the distribution of the *post-mortem* livid stains see p. 217.

Fibrinolysis. There has been a good deal of controversy about the conditions which lead to fluidity of the blood after death in certain cases. It has usually been taught that in asphyxia the blood remains fluid for longer than normal, due, it was supposed to some change in the availability of calcium.

Recent work has shown that fibrinolysin appears, from whence it is not certain, as a result of a wide variety of stimuli both physical and nervous. It has been assumed that fibrinolysin may cause lysis of a blood clot when absorbed on the surface of the clot but does not actively impede clot formation. Recent work of Mole[1] has clarified the mode of action of these ferments but has not added to our knowledge of the effects of asphyxia in connection with developed clotting.

The following observations, obtained from *in vitro* and *in mortuo* investigations, provide a summary of present knowledge[2]:—

(1) Blood is spontaneously coagulable in all cases of sudden death where the autopsy is carried out within an hour or so of death.

2. The spontaneous coagulability of blood may disappear as shortly as one and a half hours after death.

3. Fibrinogen was absent from *post-mortem* blood samples which had lost their power of spontaneous coagulation.

4. Fibrinolysin obtained from *post-mortem* blood acts only on fibrin and not on fibrinogen.

5. Fibrinolysin acts by becoming absorbed on to the clot as it is being formed, and it is later released into solution when the clot lyses. It is not effective when added to clot already formed.

6. Fibrinolysin is probably produced by the endothelial linings of the vascular channels and body cavities.

7. The concentration of fibrinolysin in the blood does not increase after death.

8. Cachexia, infection and fat embolism inhibit the production of fibrinolysin.

It is clear that uncoagulable fluid blood is normally present in the limb vessels and often in the heart of any healthy person who dies a sudden natural or unnatural death from almost any cause. The finding of fluid blood at autopsy does not in itself give any precise indication of the cause of death.

The stimulus necessary to cause the liberation of fibrinolysin is not clear, but in all cases where a fibrinolysin was demonstrable a period of "shock" or "collapse" has most probably existed for a short time before death; it has been suggested that the liberation of fibrinolysin is due to some non-specific general reaction to injury[3].

Post-mortem Bleeding. After death, the heart having ceased to beat and the veins being more easily distended than the arteries, the blood remains in the veins in a stagnant condition, and, under normal circumstances, remains for a time in a fluid condition. In these circumstances a vein which has been opened after death may bleed *post-mortem* and give rise to suspicion that the wound was produced before death. Such an extravasation of blood, *post-mortem*, may, of course, spread into the tissue spaces or body cavities, especially where these have been loosened or stripped by the process of dissection, or where the dead body has been crushed or the limbs avulsed by running over[4].

A police officer, thrown at night from his bicycle by a non-stop car, struck his head on the ground and lay unattended. A second car ran over the victim some few

[1] Mole, R. H., 1948. *J. Path. Bact.*, **64**, 413.
[2] Mant, A. K., 1953. In *Modern Trends in Forensic Medicine*. Ed. Keith Simpson. London, Butterworth.
[3] Selye, H., 1946. *J. clin. Endocrinol.*, *N.Y.*, **6**, 117.
[4] Prinsloo, I., and Gordon, I., 1951. *S. Afr. med. J.*, **25**, 358.

minutes later before the driver had time to avoid the body. *Two groups of injuries* could be detected:

    (*a*) Injuries to the right elbow, right shoulder and head from which there was considerable extravasation of blood including the inhalation of blood from the nose injury into the deepest recesses of the air passages.

    (*b*) Crushing injuries to the middle of the trunk caused by the passage of a wheel and resulting in injuries to the mesentery and right kidney amongst other effects. None of these injuries were accompanied by bleeding to anything like the extent of the injuries in (*a*).

It was, therefore, obvious that death (from the head injuries) had taken place before the second car had run over the body.

Post-mortem Changes in the Cerebrospinal Fluid

Changes in the cerebrospinal fluid occur rapidly after death. These changes may consist either of concentration or dilution of certain of the constituents. Such changes, it has been suggested, might be used to estimate the time since death as they follow with a certain degree of constancy during a period of about 15 hours. These sequelae have been used in Denmark as a method for estimating the time of death[1].

The constituents of the cerebrospinal fluid which have been studied are:

> Potassium,
> Lactic Acid,
> Non-protein Nitrogen, and
> Amino-acids,

and though the changes are well worth investigating they cannot yet be relied upon to give any particular precision in fixing the hour of death.

Unfortunately also the presence of blood in the cerebrospinal fluid influences the concentrations of these substances, and this further reduces their value.

process, including the musculature of the heart and vessels, the platysma of the skin, the erector pilæ muscles (contraction of which leads to cutis anserina), and the dartos leading to retraction of the penis. The chemical changes which take place in muscle tissue during contraction and relaxation are not completely understood and the series of changes by which carbohydrate is utilized for the production of energy is highly complicated and extensive. For details of these changes and the part which various compounds of phosphorous, especially adenosine triphosphate (A.T.P.) play in this release of energy the reader must consult the current theories to be found in works on physiology. Certainly when sufficient oxygen is not available lactic acid tends to accumulate in the muscles together with inorganic phosphates. Finally the whole of the A.T.P. becomes broken down, and the lactic acid accumulation reaches a level of about 0·3 per cent, at which point the muscle goes into an irreversible state of contraction known as *rigor mortis*. In its initial phases the process is essentially similar to muscular contraction in life, but is not reversible.[1]

There are, in regard to its medico-legal relationships, several independent points to be considered, and these we shall take in the following order:

1. The differences between living contraction of a muscle and *rigor mortis*.
2. The time of onset of *rigor mortis*.
3. The time of disappearance and the circumstances influencing it.
4. The order of its appearance and disappearance in different muscles.
5. *Rigor mortis* in involuntary muscles.

(1) CONTRACTION v. RIGOR MORTIS

1. Contracted muscle is more or less transparent, or rather translucent.

1. Muscle in *rigor mortis* loses this translucency, and becomes opaque.

2. It is very elastic i.e., capable of restoration to its original form as soon as the distorting force has ceased to act.

2. It has lost this elasticity, and readily maintains a distorted position.

3. In reaction to litmus it is either neutral or slightly alkaline, and any reduction in this alkalinity is very speedily removed.

3. It is distinctly and constantly acid (until decomposition is advanced) owing to the development of sarcolactic and other acid metabolites.

4. If the contraction be overcome by mechanical force, the muscles, though they may remain for a time uncontracted, possess still their inherent power of contraction: they may then keep the limb fixed in a new position or allow a return to the old position.

4. If *rigor mortis* be overcome by mechanical force, absolute flaccidity, corresponding in degree with the amount of mechanical movement, at once ensues, and there is no power to resume the old position nor any new one, except so far as gravity may cause a new position. This flaccidity is permanent till decomposition destroys the muscle.

(2) TIME OF ONSET OF RIGOR MORTIS

Rigor mortis generally commences within two to four hours of death, while the body is cooling, but long before it has reached the temperature of the

[1] Gyorgyi, S., 1947. Chemistry of Muscular Contraction. N.Y.: Academic Press Inc.

surroundings. To this general statement there are, however, numerous exceptions, some of which can be explained by the well-known principles of physiology mentioned above, while others hardly admit of such satisfactory explanation. Its ultimate onset is a matter concerning the muscles only, and is independent of the integrity of the nervous system, for a division of nerves leading to particular muscles or even the removal of the brain has not been found to prevent its occurrence; it also occurs in amputated limbs.

In the case of *R.* v. *Alcott* (Surrey Assizes, 1952) a young man was found stabbed to death in a railway booking office. When he was first examined, one hour after the crime, rigor mortis was absent; two hours later, however, it was complete. The deceased had fought the attacker vigorously before receiving a fatal wound.

Thus it is easy to understand that it should come on slowly in healthy, muscular subjects who have died without convulsions, as, for instance, by decapitation, by sudden hæmorrhage, by judicial or even other forms of hanging. In such cases the muscles have no more than the average amount of waste products in them, and have their usual circulation at the moment of death, conditions favourable to the continuance of local life, of which it must be remembered that rigor marks the end.

It is also easy to offer, in some measure, an explanation of why it should set in rapidly in new-born infants. Their muscles are engaged in a very active process of growth, and consequently have no large reserve of energizing materials available for continued local life.

Ante-natal Rigor Mortis. Two cases of this condition are reported[1]. The first case occurred in a quadripara, aged 35, in labour near term with a history of 12 hours' hæmorrhage. Version was performed as soon as possible, and was rather difficult owing to the rigidity of the child. When extracted, the lower limbs were still slightly stiff, and the arms markedly flexed and rigid. The rigidity did not return. Fœtal movements had ceased for ten hours. No attempt had been made to hear the fœtal heart. The second case occurred in a primipara, aged 30, in labour at term. The labour was slow, and the membranes ruptured early, and five hours later the fœtal heart could not be heard. The fœtus was extracted by forceps later on, and was in pronounced rigor mortis. There is no doubt that rigidity does interfere with delivery, in spite of statements to the contrary. Of the various conditions associated with ante-natal rigidity hæmorrhage seems the commonest.

Rigor mortis is thus proved to be of no value as a sign of live-birth. Though of course it does not indicate the contrary.

Again, it is quite in accord with our data that all circumstances which cause an exhaustion of muscles during life should induce an early occurrence of rigidity. Thus violent exercise or exertion just before death accelerates the onset of rigor, as is well seen in hunted animals, in overdriven cattle, in cases of poisoning by strychnine, and other convulsant poisons. The bodies of soldiers killed in the early part of a battle become rigid slowly, while the bodies of those who are killed after many hours of violent muscular exertion become rigid almost immediately.

It is now quite clearly established that though the onset of stiffening is likely to be observable in two to four hours after death it may be accelerated or delayed in a variety of circumstances.

(3) WHEN DOES IT DISAPPEAR?

It has been suggested that flaccidity following *rigor mortis* is caused by the action of the alkaline liquids produced by putrefaction. There can be no doubt that those circumstances at death which tend to leave a muscle full of

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[1] Paddock, C. E., 1903. *Amer. J. Obstet.*, 48, 145.

products of its own disintegration, presumably unstable organic bodies, tend to shorten the duration of *rigor mortis* and to hasten the onset of decomposition. These are precisely the conditions which, we have seen, hasten the onset of rigor, and from these facts the well-known rule follows as a matter of course, viz., the sooner rigidity sets in the more quickly it disappears and gives way to putrefactive processes.

On the other hand, myosin is soluble in acids, and the view has been put forward by Hermann that the disappearance of rigidity is due to solution of myosin by excess of acid produced during the continuance of rigidity.

A third supposition is that in *dead* muscle enzymes are developed which have the power of dissolving myosin by a process of auto-digestion.

Speaking in general terms, *rigor mortis* lasts for from 16 to 24 hours in sound, muscular subjects; it may however in apparently normal cases last from 24 to 36 hours, and exceptionally it may continue for several days.

In a case in which Taylor was consulted, a stout muscular man died suddenly from an attack of apoplexy. His body was exhumed and examined three weeks after death *in the month of January.* It was in a good state of preservation and the limbs were so rigid that it required a great degree of force to bend them.

No doubt in this case cold favoured the deferment of onset and continuance of rigidity. We have seen a body enter a state of rigidity eight days after death by immersion in Icelandic waters.

The Influence of Atmospheric Conditions. Atmospheric changes appear to modify considerably the duration of this state. Dry, cold air will cause it to persist and thus it is that during the winter season, especially in a frost, it is slow in disappearing, its mean duration being then from 24 to 36 hours. If the air is warm and saturated with humidity, it soon ceases. In the tropics, where the temperature ranges between 80° and 100°F., rigor usually begins to disappear in 18–24 hours. Temperature appears, therefore, to affect its duration and intensity.

Sommer found that, other things being equal, bodies became rigid as quickly in an atmosphere of from 59° to 63°F. as in one from 77° to 81°F.; but that the bodies of strong persons continued rigid for eight or ten days at a temperature of from 36° to 45°F., while rigidity disappeared in from four to six days when they were exposed to a temperature of from 65° to 86°F.

Bodies sunk in cold water soon pass into this state, and retain the rigidity for a long time. Water is a better absorbent of heat than air, and tends to retard putrefaction.

It has been noticed that, whereas in the majority of bodies *rigor mortis* is well marked, it is frequently absent in the bodies of those who have died from generalized septicæmia; *and especially has this been the case in separate limbs which have been the seat of purulent infiltration amongst the muscles.* This is a most striking phenomenon, owing to the contrast between the rigid and the flaccid muscles.

In this case the duration is obviously in strict accord with the condition of the muscles in regard to the amount of products of *disintegration* still present at the time of death compared with the activity of healthy circulation through them (*vide supra*).

Influence of Death by Lightning. It was at one time thought that *rigor mortis* did not occur after death from lightning but this idea is incorrect. *Rigor mortis* may occur quite normally after deaths from lightning or electrocution, but on the other hand owing to the violent convulsions of the muscles which occur in deaths from these causes the rigor may come rapidly and pass away with equal rapidity.

(4) THE ORDER IN WHICH IT APPEARS IN DIFFERENT MUSCLES

Cadaveric rigidity first appears as a rule in the muscles of the face, neck and trunk; it then takes place in the muscles of the upper extremities, and lastly in the legs. Shapiro[1] drawing attention to the physiochemical nature of the change, suggests that the process may start at about the same time everywhere, merely fixing the smaller muscle masses (*e.g.*, of the face and jaw) before those of the limbs. This suggestion however does not explain why the small muscles of the fingers and toes should be the last to stiffen. In regard to its disappearance the muscles of the lower extremities will often be found rigid, while those of the trunk and upper extremities are again in a state of relaxation. It appears later and lasts longer in the lower extremities than in other parts of the body. It begins almost always in the neck and lower jaw. Sommer found only one exception to this rule in examining 200 dead bodies. From the neck it passes in two directions: upwards to the muscles of the face and downwards to the muscles of the upper extremities and trunk, then attacking those of the lower extremities. In individual limbs, it commonly proceeds from above downwards, and it generally passes off in the same order. It always *sets in,* increases, and decreases imperceptibly and gradually, in which respect it differs strikingly from other forms of rigidity in muscle.

(5) RIGOR MORTIS IN INVOLUNTARY MUSCLES

The involuntary as well as the voluntary muscles are subject to cadaveric rigidity and, by reason of either their small mass or of the more speedy loss *of muscular irritability, it appears in them more rapidly. The ventricles* of the heart commonly lose their irritability within an hour after death. The muscle becomes rigid, and remains in that state for ten or twelve hours, sometimes for 24 or 36 hours, then again becomes relaxed or flaccid. At a certain period after death the heart becomes rigid and firmly contracted. If examined when rigid, it may appear to be in a state of spasm and to have its walls thickened, while the cavity of the left ventricle may be described as being much smaller than in the normal state. This natural condition of the heart after death has led to mistakes, the walls being described as thickened and the cavities as being diminished in size, and the heart itself as being in a

[1] Shapiro, H. A., 1950. *Brit. med. J.*, 2, 304.

state of concentric hypertrophy from disease. On the other hand, the relaxation of the heart which follows at a later period after death has been mistaken for, and described as, a morbid flabbiness and flaccidity. Spasms or paralysis cannot be inferred to have existed when we discover these conditions of the heart in the dead body.

The point is of importance with regard to deductions made as to the cause of death from the *post-mortem* appearances of the heart and blood-vessels of the brain. Thus it must not be assumed that death was caused by asphyxia because the heart is found relaxed and full of cyanotic blood nor can the cause of death be decided from the amount of blood still within heart and vessels.

Effect of Freezing. When a body is frozen so rapidly after death that there has been insufficient time for acid metabolytes to appear in the muscles the process of *rigor mortis* is suspended until thawing takes place. When the body thaws *rigor mortis* appears with great rapidity and passes off very rapidly.

Effect of Heat. All muscle protein in the body is coagulated at temperatures above 65°C. Therefore, when a body is subjected to temperatures above the coagulation point of the muscle protein a degree of rigidity is produced, which, if complete, is far more intense than that found in *rigor mortis*. Changes in posture, especially of the limbs, may follow (see Section on Burns). This heat stiffening cannot be broken down by extending the limbs as in *rigor mortis*, and it will persist until putrefaction sets in. Heat stiffening may also follow high voltage electric shocks such as occur when a person grasps a high tension cable, for sufficient heat, is often liberated at the point of contact with the cable to cause heat stiffening in the local muscles.

Instantaneous Cadaveric Spasm. This is a phenomenon which lies quite outside any of the laws hitherto considered regulating ordinary *rigor mortis*, and yet is one of the most important in legal medicine, owing to the certainty of the conclusions which may be drawn from it when it occurs.

Ordinarily, immediately after death, the muscles enter into a state of relaxation, though they are still irritable and capable of being stimulated into contraction. The point we have now to consider is the undoubted fact that *this period of flaccidity may be absent*, and that the body may be *instantaneously stiffened* in the position in which it was *at the moment of death*.

We will first illustrate this historic observation by a few cases about which no suspicion can be entertained that the manner of death was not as it is related to have been.

he must loosen them and again try to refix them by pressure, of which second-
ary fixing there will again be evidence, not to mention that the renewed
stiffening of the muscles will not take place.

The following cases collected by Taylor are illustrative of the above con-
clusions and of their importance.

In the case of Lord William Russell, who was murdered by Courvoisier in 1840,
it was observed that one hand of the deceased firmly grasped the sheet of the bed,
as if in a struggle against an assassin. The position of the hand of the deceased
furnished among other circumstances, some evidence against the presumption
of suicide.

In *R.* v. *Ellison* some of the prisoner's hair was found grasped in the victim's hand.
The body of the deceased was found lying dead in a house, with injuries that made
it clear that she must have been murdered. In her right hand was found a con-
siderable quantity of brown hair, and in the other hand some grey hair, grasped
evidently in the struggle for life. On the morning following the murder the prisoner
went to a hairdresser's in the town, and desired to have his hair and whiskers cut.
This man observed that the hair and whiskers had been recently cut, and evidently,
by someone unaccustomed to haircutting. There was a difference between the hair
of the whiskers and that of the head, the former having turned grey. The hairdresser
was of opinion that the hair found in the hands of the deceased was of the same
colour and kind as the hair of the prisoner. This, with other corroborating circum-
stances, led to his conviction.

In *R.* v. *Gardner* a woman had died from several wounds in the throat which
could not have been self-inflicted, and a common table-knife was found loosely in
her right hand, with the back of the blade towards the palm of the hand, and the
weapon in the direction of the length of the body. According to the evidence of
the medical witnesses, the principal wound in the throat was of such a nature that
it could not have been inflicted with the right hand. The knife, it was alleged, had
been placed in the hand after death.

· On this opinion, that there had been interference with the body after death,
Taylor remarked: "On these occasions it may be suggested that a weapon,
although grasped by an alleged suicide to inflict the death-wound, may either
drop from the hand or be found loosely in it, as a result of the
relaxation of the muscles in death. This must be admitted; hence the
mere fact of a weapon being found loose should not be taken as evidence of
murder, unless other circumstances – such as the nature of the wound, the
freedom of the hand from blood, the position of the body, etc. – concur to
prove that the act was not one of suicide". Other circumstances may show
that the weapon has been placed in the wrong hand, or that the blood-marks
on it and on the hand do not correspond.

The difficulty of thus endeavouring to imitate an act of suicide, when the
facts are properly observed and compared, will be apparent from the following
case.

All the circumstances concurred in showing that an attempt had been made to simulate an act of suicide, while the facts were only consistent with homicide. The prisoner was connected with the act by moral as well as circumstantial evidence, and he was convicted and executed.

In drowning, it is by no means unusual to find, when dead bodies are taken from the water soon after the accident, that pieces of rope, an oar, grass similar to that growing on the banks, or weeds like those growing at the bottom of a canal or river, are firmly grasped in the hands. This latter constitutes very strong proof that the individual has gone into the water living (*vide* "Drowning"). Part of a dress may be thus found grasped in the hand, and serve to identify a person accused of murder.

LATE SIGNS OF DEATH AND POST-MORTEM CHANGES

Putrefaction

This is the final stage in the changes following death. Strictly speaking, putrefaction means the destruction of nitrogen-containing substances, brought about by the influence of bacteria, with the production of foul-smelling gaseous products. In bodies openly exposed to the air, water, and soil, etc., various animals—ants, beetles, flies, rats, fish, etc.—assist in the destruction of the body, but this is a supplementary process; under ordinary circumstances micro-organisms alone are responsible for decomposition.

The breaking down of the protein compounds (known as putrefaction) takes place in stages, and at one and the same moment a large number of chemical substances may be present in the putrefying mass. Of these many have been chemically identified, such as formic, acetic, butyric, valerianic, palmitic, lactic, succinic and oxalic acids; amines and amino-acids, such as leucin and tyrosin; and various aromatic substances like indol and skatol. Mercaptans are formed in anærobic putrefaction. Variations in the putrefactive process depend on a series of factors many of which are not completely understood.

These putrefactive processes are almost entirely the result of the activity of micro-organisms that originate mainly from the bowel. The large bowel in life contains a great variety of organisms both ærobic and anærobic, and of the latter the most important organism in the initiation of putrefaction, appears to be the bacillus Cl. Welchii.

Shortly after death, in cases where the process of dying has been slow, or where death has been accompanied by a bacteriæmic condition, especially intestinal obstruction, before death, these organisms pass in increasing numbers from the bowel into the blood vessels and spread rapidly throughout the body. Initially the bacteria recovered from *post-mortem* tissues are mixed, consisting of coliform organisms and anærobic bacteria, but after a time the anærobic organisms predominate.[1] The organs receiving the largest blood supply, and those nearest the source of bacteria, naturally receive most bacteria and normally putrefy first. The flanks of the abdomen will usually show the earliest colour change in about 36-48 hours.

The bacteria liberate a number of ferments or enzymes and these break down the various tissues of the body, different enzymes acting on carbohydrates, fats and protein. One of the most important enzymes is the *lecithinase* produced by Cl. Welchii. This hydrolyses the lecithin which is present

[1] Burn, C. G., 1934. *J. infect. Dis.*, 54, 395.

in all cell membranes including blood cells, and thus is responsible for the hæmolysis of blood *post-mortem*.

At and around the normal body temperature (98·4°F.) Cl. Welchii multiplies freely. The rate of multiplication, however, is slowed as the temperature falls, and below 70°F. propagation is almost at a standstill. though most of the enzymes or ferments produced by the bacteria will continue to act at much lower temperatures, even temperatures around freezing point. Thus the initial spread of putrefaction is largely influenced by two factors (1) the cause of death, and (2) the period of time that the internal temperature of the body remains above 70°F.

(1) In cases where persons die from acute intestinal obstruction there is usually a profound bacteræmia before death so that when actual death occurs the organisms from the bowel are already spread throughout the body, and although the body temperature may fall rapidly putrefaction commences almost immediately. This state of affairs is accelerated when death is due to an infective condition caused by gas-forming organisms, and in septicæmia.

Suspicion of phosphorous poisoning was raised by a resident medical officer at a Portsmouth hospital owing to (a) jaundice, (b) recurring vomiting and (c) purpuric skin patches developing in a woman of 22 who had been admitted for an incomplete abortion during the afternoon on the day of her death: she had been ill only 16 hours in all when she lapsed into coma and died. Autopsy revealed a hæmolysis of the blood in circulation, scanty gas formation, and a recently emptied uterus, enlarged to about three to three and a half months gestation size, the interior of which was remarkably dry looking; the wall crepitated and (together with a heart blood sample) gave a strong growth of Cl. Welchii.

(2) The period of time that the internal temperature of the body remains above 70°F. is clearly of paramount importance, as it is only above this temperature that the main putrefactive organisms will continue to multiply with any rapidity throughout the body. Any factor which delays the cooling of the body (see p. 167) will therefore hasten putrefactive processes.

Bearing in mind that environment may considerably alter the course of putrefaction, we may now describe the process as it usually occurs, and consider the important points in connection therewith.

To facilitate reference. a table is here inserted of the order of discussion:

(1) Colour changes, external and internal.
(2) The gases of decomposition.
(3) The effects of these gases.
(4) Circumstances influencing the onset and progress of decomposition.
(5) Observed facts in the order of decomposition in the body.

on a background of lighter red, purple, green, or black skin: the change is aptly described as a "marbling" of the skin.

Internally much the same change of colour is observable in the viscera— liver, spleen, kidney—though shades of dark red, varying to black, are commoner tints than green. The bile also soaks through from the gall bladder and tinges the adjacent tissues with a yellow, or greenish colour, which resembles in some respects that of decomposition. With this colour change the viscera become softer and greasy to the touch; they eventually break down into a uniform stinking mass, so that the individual organs can no longer be separately removed.

It is important to remember that these colour changes are *early* signs of decomposition, and that the organs, though discoloured, will still show many pathological changes; it is therefore most unwise to decline to proceed with an examination on the supposition that the organs may be too decomposed to reveal any facts of importance: it is, indeed, never too late to do an autopsy, diminished as its value may be.

2. GASES OF PUTREFACTION. During putrefaction a great number of gases are found, including many organic substances and compounds of sulphur which smell offensively. Thus we find not only hydrogen sulphide, ammonia and phosphoretted hydrogen but also mercaptans and less offensive gas such as marsh gas and carbon dioxide.

Lewis reported, in 1852, on the external condition and appearance of 22,000 coffins accumulated in the vaults of London churches. He examined the state of the contents of about 100 of these, including the bodies of persons of all ages, and coffins which had been deposited from a short period to upwards of a century. He did not find therein sulphuretted, phosphoretted, or carburetted hydrogen, or any compound of cyanogen. The gases which he uniformly detected in the coffins and the vaults were nitrogen, carbonic acid, atmospheric air, *holding putrescent animal matter in suspension*. Ammonia was occasionally found in large quantities; this when present overcame all other odours, when absent the animal matter had a smell resembling that of putrid moist cheese. He opened one leaden coffin in which the corpse had been enclosed for nearly a century; The ammoniacal gas which escaped from it formed dense white fumes when brought into contact with hydrochloric acid gas. It was so powerful that he could not remain near it for more than a few seconds at a time.[1]

The same results were noticed in reference to a body which was exhumed after six months' interment. When the coffin lid was removed by the side of the grave a large quantity of fœtid ammonia escaped. On throwing into the coffin some chlorinated lime dense white clouds of chloride of ammonium were evolved from the interior of the coffin, to the great alarm of some of the bystanders, who were not aware of the chemical changes produced.

It would appear that the air enclosed in coffins in general contains no oxygen. When tested it was not inflammable, but was found, in every instance, to extinguish flame. In leaden coffins putrefaction is so much retarded that the remains of bodies were found in them after the lapse of a century. The metal is slowly corroded and changed into white lead.

The chemical composition of these gases may be of little apparent interest, but the points that are of importance are that they form beneath the skin, in hollow viscera, and, eventually, in solid viscera, exert considerable pressure, and produce effects that are of some medico-legal importance.

3. EFFECTS OF PRESSURE OF THE GASES OF PUTREFACTION. (a) **Blood Displacements.** We have already drawn attention to the fact that after death the arteries, by virtue of their elasticity, empty themselves into the veins, and may thus cause a *post-mortem* hæmorrhage from a wounded surface (vein or capillaries). We have here to mention the more special effects of decomposition which cause—

Post-mortem bleeding at a later date than that mentioned above. This form does not offer so much difficulty in deciding whether the wound was *ante* or *post-mortem*, because the resulting outpouring of blood will show no trace of coagulation; it will have simply soaked into the surroundings like so much coloured fluid.

Shifting of an Area of Hypostasis. Owing to the pressure of the gas developed in the blood of a hypostatic area, this may be displaced in any direction. Taylor saw a body in which the cheeks acquired a florid red colour between the third and fourth days after death, when rigidity had ceased.

The importance of the fact lies in this, that when once putrefaction has commenced in a dead body the inferences as to the position in which the corpse has lain since death will be materially weakened so far as they rely upon the position of the hypostases for their support.

Emptying of the Heart. When putrefaction has commenced, and there is no open wound from which the blood can escape, the cavities of the heart may have a portion of the blood forced out of them, but it is not probable that the cavities could be completely emptied by this process. If the heart is found empty, and at the same time contracted, its emptiness could be assigned to the effects of putrefaction; the natural condition of the organ shortly after death may still persist in spite of decomposition.

(b) **Bloating of the Features.** We have already mentioned how death alters the features so as to make recognition less easy. With the onset of putrefaction the features are so blown up, swollen, and altered in colour, that identification becomes absolutely impossible. Indeed, the likeness to a human being is sometimes difficult to realize, when lips, nose, eyelids, and cheeks are distended into a bulbous green mass. The eyes may be forced forward almost from the sockets and the tongue become blackened and forced forward against the teeth or even protruded between them, and thus a picture of violent death from strangulation may be so closely imitated. It is impossible to lay down any rules of general application to differentiate between the two. The facts only emphasize the caution which must be used in deciding that death was due to strangulation when a body is found very advanced in decomposition.

(c) **Extrusion of Fluid from the Mouth.** Froth and other matters may be observed running from the mouth in many conditions and the examiner must be on his guard in assuming that it is due to any particular cause of death. It is commonly present in death from drowning and in certain types of poisoning, but it may also be found in any condition in which there has been excessive fluid secretion into the lung. In putrefaction, froth and stomach contents are commonly seen issuing from the mouth and nose. The finding of such substances below the larynx, in the trachea or bronchi, however, is likely to have happened in life, if only terminally.

(d) **Extrusion of the Fœtus from the Uterus.** A case of this kind was seen by one of us:

A woman of 27, dying in hospital of "septicæmia following abortion", was prepared by a nurse for transfer to the mortuary: she had not then any discharge or conception product visible in the vagina which, with the rectum, was plugged with wool in the usual manner. When seen 20 hours later lying on the mortuary slab she was found to have a macerated three months fœtus with shredded membranes lying external to the vulva: a slightly sanious, laked, discharge bubbled slowly from the vagina, and the uterus was found to contain the same kind of material together with a partly detached placenta from which the cord led to the fœtus.

A similar case was reported by Gordon and Turner[1] in 1953:

A native woman who died in childbirth before the delivery of the infant was exhumed some two weeks after burial. Marked putrefaction was then present, and the fœtus still attached by the cord, was found between the thighs.

It has thus been established beyond doubt that *post-mortem* extrusion of a fœtus is possible.

It is obvious that in certain cases this condition might be used to cover and conceal a case of criminal abortion. The subject was brought before the Medico-Legal Society of Paris by Pénard.

He was required to report on an alleged case of delivery 36 hours after the death of a woman in which the question of expulsion by gaseous putrefaction could not arise. A young woman died under suspicious circumstances after eight days' illness. It was only just before her death that the medical man in attendance discovered that she was pregnant, and had probably reached the fifth month. He made no examination after death, and when the body was laid out there was no unusual appearance. When raised to be placed in a coffin, 36 hours after death, a fœtus fell from between the legs of the corpse. On examining the body, the uterus was found with the placenta attached, inverted, and extruded from the outlet.

Pénard, after fully considering the case as submitted to him, came to the conclusion that after the death of the woman the uterus would not have the power of expelling the fœtus and inverting itself by spontaneous muscular contraction. We cannot admit the possibility that a spontaneous action of the uterus after the death of the woman should be so powerful as not merely to expel the fœtus and placenta, but further to invert and prolapse the organ. In these rare instances it is tolerably certain that parturition commenced before death. In the case related by Pénard, the woman had only reached the fifth month and was not examined after death. At this stage of pregnancy, it is improbable that the *post-mortem* contractions of the uterus, without any assignable cause, would have operated to expel the child *and invert the organ.*

(e) Floating of a Body in Water. The specific gravity of the whole body is only a little greater than that of water. Consequently, apart from other mechanical considerations, a dead body will sink until sufficient gas develops to make its specific gravity less than that of water. It then rises, and if the gas escapes it may sink, until it develops sufficient gas to cause it to refloat (*vide* under "Drowning").

will influence the process of putrefaction. These factors will now be dealt with in more detail in the following order:—

   (a) The temperature of the air to which the body is exposed;
   (b) The presence of moisture;
   (c) Presence of clothing;
   (d) Influence of access of air;
   (e) Influence of light;
   (f) Influence of the state of the body;
   (g) Influence of the nature of death;
   (h) Influence of immersion in water;
   (i) Influence of burial in earth.

(a) **The Effects of Temperature of the Air.** Putrefaction is found to proceed most rapidly, when the body temperature remains beneficial to the growth of bacteria (an air temperature of between 70° and 100°F.), provided of course that factors detrimental to the propagation of bacteria are not present. When the organisms have been distributed about the body and have already liberated their enzymes, obvious putrefaction will commence, although delayed, at any temperature above 50°F. At 32°F. (freezing point) decomposition appears to be wholly arrested; however, certain bacterial enzymes will continue to act slowly at that temperature. A dead body may thus be preserved indefinitely in refrigerators, snow, ice, or in freezing soil.

Erman states that the body of Prince Menchikof, one of the favourites of Peter I., was exhumed at Beresov, in 1821, after a burial of 92 years in the frozen soil of Siberia. Although so long a time had elapsed the body had undergone but little change. The heart and some other parts, with a portion of the grave-clothes, were removed and sent to the descendants of the deceased.[1] A still more remarkable instance of the preservative power of cold is exhibited in the discovery in a mass of ice at the mouth of the river Lenz, in Siberia, in 1805, of the body of an ancient elephant the race of which was extinct before the historical period.[2]

At high temperature, i.e., 120°F. or over, bacterial growth usually ceases, putrefaction is arrested, and mummification takes its place as a late *post-mortem* change.

The effect of the temperature of the air is strikingly seen in the influence of season. Thus in summer a body may show more putrefactive changes in 24 hours than a similar body under the same environmental conditions will show in 10 to 14 days in winter. The environmental temperature must always be carefully considered when attempting to assess the time or date of death of a cadaver.

(b) **The Influence of Moisture.** A certain degree of moisture is necessary for the processes of putrefaction. The animal solids, however, commonly contain sufficient water for the establishment of the process. In a human body weighing 150 lbs. there are about 100 lbs. of water. The soft organs differ much from each other in regard to their constituent tissue and of liquid contained in them, and therefore in the degree in which they are prone to putrefaction. Thus the brain and the eye are in this respect contrasted with the teeth, bones, hair and nails. The fluids of the eye are rapidly decomposed, while the teeth and hair may remain for centuries unchanged.

Quekett examined a portion of dried human skin with hair upon it which had been exposed for many centuries on a door of Worcester Cathedral, and also other portions taken from the church doors of Hadstock and Copford, in Essex. He found upon them some hairs which were proved by the microscope to be human, thus confirming the old tradition that the skins of persons who had committed sacrilege were nailed to the doors of the churches which they had robbed.

If an organic substance is dried, putrefaction is arrested. Dehydration of food stuffs is now in everyday use as a means of preservation.

(c) **The Presence of Clothing.** The effect of *clothing* on decomposition after burial or immersion in water is discussed under the respective headings, but mention should be made here of the effect of clothing on decomposition of bodies exposed to air. Clothing acts initially by hastening putrefaction by maintaining the body temperature above that at which putrefactive organisms multiply for a longer period. Tight clothing delays putrefaction owing to the pressure producing a degree of bloodlessness in the part. At a later stage clothing delays decomposition by protecting the body against the ravages of flies and insects. Fly larvæ not only hasten the decomposition of a cadaver by directly attacking the soft tissues but also by generating heat which may raise the body temperature to a level well above that at which putrefactive organisms multiply.

(d) **The Influence of Access of Air.** Air influences decomposition mainly by (1) its temperature, and (2) its moisture content.

Bacteria are normally present in the air but it is unlikely that these by themselves play any significant part in the process of putrefaction. Flies and their maggot larvæ introduce a supplementary process which may aid decomposition.

(e) **The Influence of Light.** This has no practical influence on the putrefactive processes, except that flies and other insects avoid those parts of the body exposed to direct light, tending to lay eggs in crevices like the eyelids.

(f) **The Influence of the State of the Body.** It is not possible to state without knowledge of all the other factors whether the state of the body, be it fat or emaciated, has influenced the rate of putrefaction. The earlier stages of putrefaction are usually hastened when the body is fat or flabby. Dehydration tends to retard the course of decomposition throughout its course.

The bodies of newborn or still-born infants are normally sterile, and thus putrefaction can only occur by the invasion of the body by external organisms. As the body of a newborn child cools rapidly, putrefactive organisms can rarely gain a foothold and thus it is unusual for putrefaction, in the sense that it is applied to adults, to occur. In a warm dry environment newborn infants rapidly mummify.

Care must be exercised when examining a body which has been dismembered at the time of death. In most instances the limbs will be devoid of putrefactive organisms and hence their decomposition will be slow; the trunk, however, will putrefy more rapidly than normal.

(g) **Influence of the Nature of Death.**

Acute Disease. The bodies of persons who have died from acute diseases usually putrefy more readily than those persons who have died from wasting or chronic disease. The reason for the hastening of the putrefactive process is partly the raised body temperature at the time of death, and frequently

also the existence of a bacteræmia before death. In persons dying from asphyxia by suffocation or strangulation the putrefactive process may be slightly hastened.

Septic Diseases. In deaths from septic diseases acceleration of decomposition is the rule. This tendency is naturally most marked in cases where the pathogenic organisms which caused death are also instrumental in initiating the putrefactive process; it is a striking feature in Cl. Welchii septicæmia, as in septic abortion, and in many cases of intestinal obstruction.

Deaths from Poisons. Conflicting statements have been made regarding the process of putrefaction in the bodies of those who die from certain poisons. There appears to be no foundation in fact for believing that any poison will constantly accelerate or retard decomposition. Traditionally arsenic is believed to preserve a body after interment but this traditional belief does not appear to have any sound basis. (See "Other factors influencing decomposition after burial").

(h) **Influence of Immersion in Water.** When a body is immersed in water there arise certain factors influencing decomposition which are peculiar to this medium. Still or running water, polluted water or sea water, all have their own influence on subsequent decomposition owing to their varying bacterial and animal content; salt water crustacea may remove all the soft tissues in a matter of two or three days. Owing to the better conductivity of water, bodies will cool about twice as rapidly as in air (see p. 167).

After several hours immersion the skin of the palms of the hands and soles of the feet becomes wrinkled and sodden. If the water is well oxygenated due to its shallowness, movement or temperature, oxygen exchange takes place through the skin. A recovered body may appear quite pink irrespective of the cause of death.

Owing to the more rapid cooling of the body in water, and as for the greater part of the year the temperature of the water remains below atmospheric temperature for the whole 24 hours, decomposition *per se* tends to proceed more slowly than in air. When the water temperature is persistently below 40-45°F. the body may show no appreciable decomposition after several weeks' immersion. At 50-70°F. it may be expected after three to five days; above this decomposition may be found in two days or less according to the temperature. In the tropics for example it may be obvious in less than 24 hours.

The order of the superficial appearance of the colours of decomposition is usually altered when a body is immersed in water, thus:

Water		*Air*
Face and neck, or sternum.	In order of appearance from above downwards.	Abdomen.
Shoulders.		Chest.
Arms.		Face.
Abdomen.		Legs.
Legs.		Shoulders.
		Arms.

The researches on drowning made by Casper and Kanzler show that, while the lower part of the body may be in a tolerably fresh condition, the face, head, neck and upper part of the chest may present a reddish colour passing into patches of a bluish green, first seen on the temples, ears, and nape of the neck, thence spreading to the face, and afterwards to the throat and chest. These changes may be observed in the English summer when a body

has remained in water from four to five days, in spring and autumn from eight to ten, and in winter for a longer period. The head of a drowned person is sometimes much discoloured from putrefaction when the rest of the body is in an apparently unchanged condition; this is due to the fact that the head of a submerged body floats lower than the rest of the body; hence blood gravitates first to the head and neck facilitating bacterial growth.

The skin covering the palms of the hands and the soles of the feet is found thickened, white, and sodden from imbibition when the body has remained several days in water. Owing to this cause, ecchymoses resulting from violence during life are not always apparent on the body at the moment it is removed from water; it is only when the skin has lost the greater part of the water by evaporation that ecchymoses and other marks of violence begin to show themselves: wiping away the outer cuticle will often reveal tattoos and scars.

The influence of air upon the skin of a body which has been for some days submerged is chiefly seen, after its removal from water, in the face and chest. In a few hours, if the temperature of the atmosphere be moderately high, the face may be found bloated, and either livid or black. The features are so distorted that they cannot be recognized by those who knew the person during life. The change chiefly occurs in the skin, which becomes first of a livid brown colour, and afterwards changes to a deep green. The discolourations are chiefly apparent in those parts which are freely exposed to the atmosphere. They are not commonly found on surfaces which have been in close contact, as in the armpits and upper and lower limbs, where the former have been closely applied to the sides of the body, and the latter have remained in close proximity to each other. For the same reason the discolourations are not commonly met with at the back of the body, or on those parts which have been closely wrapped in clothes.

Clothing influences the decomposition of a body in water insomuch that it protects the soft tissues from the ravages of fish, crustacea and other small animals. When a body sinks in water with a soft bed (as opposed to gravel or stone) it often becomes partly buried in mud or silt. The exposed skin of the face and hands is then vigorously attacked by numerous worms and other animals living in the mud or silt. When the body is recovered the exposed parts may be in a most advanced state of disintegration as a result of the activity of these animals, whereas the parts protected by clothing, although showing signs of decomposition commensurate with the period of immersion, are usually intact.

some protection to the body from the attacks of small animals, and will seal up the body orifices. This latter phenomenon may be of great value.

¹ In the case of *R. v. Whiteway* the body of one of the victims was recovered from the water near Midsummer five days after rape and murder; the vagina had been completely sealed by the algæ and the vaginal contents were uncontaminated. Spermatozoa were readily recognizable on microscopical examination of the vaginal contents.

The algæ attach themselves firmly to the superficial layers of the epidermis and have to be gently scraped off before the examination of the body can begin. The superficial layer of epidermis comes away with the algæ and thus fine abrasions of the cuticle will disappear during the cleaning process.

Gaseous putrefaction takes place in bodies immersed in water, as well as in those which are exposed to air; the body acquires buoyancy and rises to the surface. It requires but a very slight generation of gases for this effect to follow, since the human body is only slightly heavier than its bulk of water.

The period of time required for a body to rise to the surface, from gaseous putrefaction, must depend on many circumstances but principally, of course, on the temperature of the water. Usually, in the height of the summer it is two to three days, and in the spring or autumn from the third to the fifth day after death from drowning (or from the eighth or ninth in deep sea-water). In winter a body may not rise to the surface for up to six weeks if the water temperature is cold. In very deep water the bottom temperature remains constant at $39 \cdot 2°F$. throughout summer and winter, and in these circumstances gaseous putrefaction will be no more rapid in summer provided the body sinks to the bottom; generally, however, the depth of water is insufficient to permit this state of affairs. Wind affects the distribution of cold and warm waters in deep lakes, and if the body is lying at the windward end of the lake although in deep water, the wind may alter the distribution of the warm layer so that the temperature of the body is raised to that in which bacteria can multiply rapidly. The gases may then be liberated, and the body will sink; they may be again generated, and it will rise. The facts connected with the buoyancy of the dead body became of great importance in the trial of Spencer Cowper[2] (1699) for the alleged murder of a woman (see "Drowning").

After some 12 to 14 days the skin of the fingers begins to become detached and may, in two to three weeks, be detached as a kind of glove, the nails loosening last. The hair becomes easily detachable by mere wiping in slightly shorter periods of time.

When several months have passed, the muscles become soft and discoloured, or the fatty parts may have been converted into adipocere. Ultimately the soft parts will be washed from the bones, and the skeleton separated

The changes due to putrefaction in the drowned or apparently drowned, even when comparatively slight, may, as Casper justly remarks, seriously affect the value of the medical evidence. The blood becomes decomposed, acquires a darker colour, and produces the appearance of congestion in the brain, lungs, right side of the heart, and other parts of the body, so as to render it difficult to form a conclusion on death from apoplexy or asphyxia.[3]

Attempts have been made by the aid of baths of formalin, chlorine, salt,

¹ Mant, A. K., 1954. *J. for. Med.*, 1, 260.
² *Famous Trials of History*, Birkenhead, 1926, p. 89.
³ Casper, J. L., 1861. *Handbook of Forensic Medicine* (New Syd. Soc.), Vol. I., p. 219.

and hydrochloric acid, as well as by injections of chlorine, chloride of zinc, and ferric chloride, so to restore the features of a drowned body as to enable persons to identify it. After the occurrence of such changes from putrefaction in the drowned as those above described it is extremely difficult to restore the features. It is one thing to arrest or prevent putrefaction by these agents, but another to suppose that the chemical changes can be reversed, and the corpse put in the position of a body recently drowned. It may be well to state here that mistakes have frequently been made by persons relying upon the features as proof of identity in the drowned.

Hollis v. *Turner* was a singular case of this kind in which it was sought to establish the death of one William Turner. This person was of restless, unsettled habits, wandering about the country, and in a state of great mental and bodily depression. On May 7th, he walked into a house at Guildford. He was shivering with ague, covered with boils and sores, and had a fortnight's unshaven beard. His sores were dressed with rags. On the following day he left the place, and was never *again* seen alive. Ten days after his disappearance the body of a man much decomposed was *found in the River Wey, near Guildford.* At an inquest held on the same day, two men, named Etherington claimed the body as that of their father, who was missing. Mrs. Waller and others who saw the body, identified it as that of Turner. The body, however, was buried as that of Philip Etherington. Some months afterwards Etherington, sen., the supposed deceased, walked into his daughter's house. The body was undoubtedly that of Turner. A fragment of an old neckerchief, found under the bed where this man slept on May 7th, corresponded exactly with a piece of handkerchief which was removed from the neck of the deceased. The Court held that the body found in the River Wey was that of Turner, and an order was made accordingly.

(i) Influence of Burial in Earth

The state of the body at the time of death. In a temperate climate a well-covered body will decompose more slowly than one which is thin or emaciated if buried under the same conditions.

Time which has elapsed between death and burial, and the environment of the body during this period. The longer the body remains above ground before burial, the more advanced is likely to be the state of decomposition, especially if the body has been kept in a warm environment. This was quite clear from a series of exhumations carried out in Germany after the 1939–45 War in cases where bodies of aircraft crew, who had all been killed at the same time but were buried at different intervals, although in the same cemetery under the same conditions. If a body is buried at great depth immediately after death decomposition is greatly delayed.

The effect of a coffin. A well-sealed coffin, especially one which is lead lined, will delay decomposition, and under such circumstances the features may be recognizable after as long as 150 years' burial. A poor coffin, however, which readily admits water tends to hasten decomposition. This decomposition is further hastened in coffins where there is a considerable volume of air.

Clothing or other coverings. Clothing or other coverings will delay decomposition when a body is buried in earth without a coffin. Under these circumstances also, adipocere (see p. 200) will form more readily, the action of the clothing being two-fold; it will afford some protection from insects, and will aid the formation of adipocere by keeping the body beneath it continually moist by absorbing moisture from the soil.

The depth at which the body is buried Generally speaking the greater the depth of the grave, the greater the degree of preservation. In shallow graves the soil is aerated, and the body itself will become the prey of a far greater

variety of insects and animals; also in summer these shallow graves, and consequently the body, will become warmed by the sun.

Type of soil. The part played by various soils in altering the rate of decomposition must be considered in every case. In heavy clay soils the formation of adipocere is encouraged whereas sandy and porous soils in general are conducive to mummification.

The presence of chemicals around the body. When a body is buried in lime, decomposition is retarded, and soft tissues are largely preserved. The preservative effect of lime was well illustrated in the case of *R. v. Dobkin* (see p. 142) where sprinkling of lime over the tissues preserved the evidence of fracture of the thyroid by strangling during life; dried bruising around a fractured cornu was well preserved and permitted microscopy.

Access of air to the body after burial. The access of air to a body after burial, provided the body has not become mummified or converted to adipocere, considerably accelerates decomposition.

Mass graves. In cases where a number of bodies are buried in a common grave without coffins, those bodies lying in the centre of the grave may be better preserved than those at the periphery.

5. Observed Facts on the Rate and Order of Putrefaction of the Body

As we have discussed previously, the *rapidity* of development of decomposition or putrefaction rests largely with the state of the body at death (p. 186) and the environmental temperature (and humidity) after death (p. 187)

Each of these factors bears upon the rate of growth of the organisms and the activity of the enzymes responsible for the gas-forming hæmolytic and proteolytic disintegration of tissues that comprise the substance of decomposition. In general, newborn infants decompose less readily than babies who have survived some time, and lean adults less rapidly than the obese and plethoric. Those with intestinal stasis or stoppage start to putrefy early, as also do those whose systems have already been invaded in their last hours of life by micro-organisms; when these are of the type that initiate putrefaction so much the earlier does the process start. *The environmental temperature* is, *ceteris paribus*, the only really significant factor in influencing the *rate* of development of putrefaction. At temperatures below 35°F. to 40°F. little change takes place over days, and at 32°F. or below the body may remain the same, as may a frozen carcase, for weeks or months. Some drying, even well marked mummification, may occur, especially in the hands and feet, ears and nose, but no putrefaction. At temperatures of 45°F. to 50°F. the process is slow but steady, at 60°F. to 70°F. quite rapid, at 80 F. to 100°F. alarmingly so: Those who work in the tropics are familiar with the fulminatingly rapid development of putrefaction. A body may, at such high temperatures, start to discolour in the flanks an hour or two after death and become badly putrefied within a day.

Humidity is an adjuvant: the body can provide moisture at the start, but later the water required for the growth of organisms and the continued action of enzymes must come from the air.

Certain "rules" may first be stated:—

(a) Decomposition starts in the flanks of the abdomen, usually rather earlier on the right side, over the cæcum: it spreads into the trunk, reaching out through the blood vessels into the tissues of the neck, face and head, arms and legs.
(b) It is more pronounced (but not developed earlier) in vascular tissues and in parts where the blood has gravitated—e.g. in the head and neck in bodies floating in water, etc.
(c) It develops, at any given season, about twice as fast in air as in water, and about a quarter the rate-in-air when the body is buried.
(d) Sewage or decomposing organic matter will hasten the process appreciably. A *stagnant* environment is adjuvant.
(e) Certain organs decompose early, others more tardily, as follows:

Early	*Late*
Intestines and stomach	Lungs
Liver	Heart
Spleen	Kidneys
Brain	Bladder
	Prostate, testis
	Uterus, ovaries.

The tougher capsules of organs like the liver survive longer *than their* softer parenchymal tissues, and they may give the appearance of a bag of turbid semi-liquid matter before breaking down finally. The brain may run liquid through the openings made in the tough dura, and the kidneys may resemble an opaque jelly within their capsules.

With regard to the period after death at which these putrefactive changes are likely to become established, the following short table[1] will be found to fit the course of events at moderate temperatures such as apply to an average English spring or autumn—giving a usual range of 50°F. to 70°F.—when no special accelerating or retarding conditions are present: —

PERIOD	LAND	WATER
Days	PUTREFACTION	
2	Green staining in flanks.	
2–3	Green and purple staining over abdomen and some distension.	
3–4	Marbling of veins. Further spread of stains into neck and limbs.	Discolouration at root of neck.
5–6	Gaseous swelling and disruption internally. Skin blebs.	Neck and face discoloured and swollen. Body floats in 6–10 days (period halved in hot weather). Decomposition well established in trunk, but little distension.
Weeks		Cuts peeling and hair loosening, easily pulled out.
2	Abdomen distended to tight tension. Swelling of body marked, and blebbing with purple transudate widespread. All organs disrupted by gas.	Nailspulled out with difficulty.
3	Vesicles bursting and tissues softening and disrupting. Eyes bulging. Organs and cavities bursting. Disfiguration to extreme.	Face swelling and becoming discoloured.
4	General slimy liquefaction and disruption of all soft tissues.	Body greatly swollen with gases and organs crepitant. Hair easily wiped away. Nails (fingers easily, toes less easily) pulled out. Casts of hands and feet separate.

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[1] Adapted from "Forensic Medicine", 1954, 2nd Ed., Keith Simpson. London: Arnold.

Broadly speaking, above 70°F. the rate becomes doubled for every 15°F. rise and below 50°F. the rate becomes halved for 15°F.; below 35°F. little putrefaction is likely to occur. Experience will show, however, that it is impossible to be didactic about such matters; such generalizations as are set out above can only act as a guide to what is well recognized to be one of the most difficult tasks in forensic pathology—that of estimating the lapse of time since death.

Putrefaction may continue in air, water, or earth, until all the soft tissues have disappeared from the bones. When this occurs the bones may undergo decalcification, and may themselves disappear. More usually, however, the process of putrefaction dies away at a late stage, and the remains of the body undergo adipocere formation, or mummification, or, more frequently, a combination of the two.

Adipocere Formation

This substance was first observed and described as "adipocire" by Fourcroy during the removal of vast numbers of bodies from the Cimetière des Innocents in Paris. He gave it this name, owing to its properties being intermediate between those of fat and wax. He considered it to be constituted of fatty matter and ammonia. The composition of adipocere however, does not appear to be uniform; but is liable to vary according to the nature of the medium to which the body has been exposed.

Properties of Adipocere. Taylor has given an account of his examination of this substance as it is found in bodies after long interment in damp graves, and his description of its properties is here subjoined. A man died and was buried at Boston in October, 1834, and his body was exhumed for judicial purposes in June, 1862. The white substance into which all the organs had been completely transformed was unctuous to the touch, and had a peculiar and highly offensive odour. When completely dried it was soft, white, somewhat brittle, with a fibrous structure, and crumbled under the knife. Examined by the microscope, it presented none of the usual characters of *muscular fibre. It appeared to be a confused network of fibres cemented by a white fatty-looking substance without trace of organized structure.* It had a disagreeable rancid odour, which was increased when the substance was heated. It was in great part dissolved by alcohol, and the solution became opaque on adding water to it. It readily floated on water, forming an opaque solution when boiled, and the greater part was dissolved, but the liquid did not become clear on filtration. The solution had a slightly acid reaction to litmus paper. When heated with potash it became clear, and evolved ammonia. The substance was almost entirely soluble in potash, and the solution gave a white precipitate with acids. It was only partially fused at 212°F. When heated in a close tube, it gave out an offensive rancid odour, evolving ammonia and traces of sulphur compounds; it readily melted, and by continuing the heat a dense oily vapour having an acid reaction distilled over, a carbonaceous residue being left in the tube. When heated on platinum it melted, took fire, and burnt with the bright yellow flame of a hydrocarbon.

Rutter and Marshall[1] gave the chemical composition of pig adipocere as follows:

[1] *Trans. Roy. Soc., Canada*, 1916 10, 169. *J. Ind. Chem.*, 1917, 29, 519.

						Per cent.
Palmitic acid .	.	.	.	.	.	67·52
Stearic acid .	.	.	.	.	.	3·3
Oleic acid .	.	.	.	.	.	5·24
i-Hydroxystearic acid .	.	.	.	.	.	9·48
o-Hydroxystearic acid .	.	.	.	.	.	6·32
Stearin and palmitin .	.	.	.	.	.	1·21
Olein .	.	.	.	.	.	0·16
Unsaponified matter .	.	.	.	.	.	0·87
Calcium soaps .	.	.	.	.	.	4·41
Protein .	.	.	.	.	.	0·665
Ash .	.	.	.	.	.	0·578
Humus and undetermined ·	.	.	.	.	.	0·247

As a result of their investigations they said that adipocere was essentially composed of saturated fatty acids, glycerides being present in traces only.

They state, *inter alia*: "Adipocere should be regarded as the product of the hydrolysis of fats by water where the time factor and the concentration of the reacting water are almost indefinitely great, and where the soluble product glycerol is rapidly removed. It seems that bacterial and enzymic action and the formation of soluble soaps play a quite secondary part in the development of adipocere from fats. The hard waxy character of the mature substance is largely due to the presence of the two hydroxystearic acids. Calcium soaps, proteins, etc., are variable incidental components."

A close experimental study of adipocere formation by one of us has shown that it is undoubtedly formed from pre-existing fat which gradually hardens as the muscular and other tissues disappear.

The hydrogenation of the unsaturated body fats into saturated firmer fats requires certain enzymes which are liberated from decomposing protein.

Though it is possible that an ammoniacal soap may be formed in the early stages, this is not an essential change.

Where Adipocere is formed. As adipocere is a mixture of fatty acids formed from certain changes in, and hydrogenation of, pre-existing body fats, it is obvious that it will be formed only in fatty parts and if a body is devoid of fat adipocere cannot form.

The formation of human adipocere is similar to the hydrogenation of vegetable fats in the manufacture of margarine, both being due to the conversion of unsaturated fatty acids. Recent work on the formation of adipocere suggests that bacterial enzymes are essential for its formation. When fat is converted into adipocere it swells and removes the water necessary for its formation from its external environment and also from the internal tissues. Water is essential in the chemical changes which occur, not only because it takes part in the chemical process, but also because it removes glycerine which is formed during hydrolysis of the fats. Some adipocere may form even when only very small quantities of water are present but in general terms water or at least a moist environment is essential to facilitate the change.

into adipocere. In one of our cases a complete examination of the stomach contents was possible as well as full data for identification nearly two years after death.[1]

Time Required for its Formation. To make an endeavour to determine this is often of importance, for a decision concerning the time of death may be the crucial point in a criminal case. The legal question of survivorship may also turn on this question and in at least two cases the shortest period required for its production has been the subject of close scrutiny in this connection.

The following case is of some interest as illustrating the above.

The deceased, who was in a state of insolvency, left his home on November 3rd; and on December 12th following—i.e., five weeks and four days after his departure —his body was found floating in a river near the place where he resided. A commission of bankruptcy had been taken out against him a few days after he was first missed and before it was known that he had destroyed himself. It became, therefore, important to determine whether he had drowned himself (for there was no doubt of his having committed suicide) *before* or *after* the date of issuing this commission. If it could be shown that he was already drowned when it was issued, the commission would be void in law and his property could not be seized under it. The litigation then turned upon the question whether he had drowned himself on the day of his leaving his house, or at some subsequent time. The body was found floating with the head and feet submerged. On being taken out the face was covered with a muddy slime. On the day before the inquest three medical men examined the body with a view to ascertain whether any change had taken place in it which could justify an opinion as to the time during which it had been lying in the water. The muscles of the buttocks were found to be converted into a fatty substance, very much resembling suet (adipocere). The face was completely disfigured by putrefaction. The hair of the head was separated from the scalp by a slight pull. The other parts of the body were firm and white, without any putrefactive appearance.

A medical witness for the plaintiffs stated it as his opinion that the body could not have been less than *six weeks* submerged. Three or four weeks would not have sufficed to produce the appearances met with; the adipocerous state of the body could not have been brought about in *less* than six weeks. He admitted that he had met with an instance in which a body taken from the Severn had a spermaceti appearance within a shorter time, although the change had not advanced so far as in this instance. Another witness supposed the body must have been under water for more than six weeks; he therefore thought the deceased's body must have been in the water during the whole time that he was absent. If it had been exposed to the air it would not have presented the appearances met with. He admitted he had said the body was in such a state that it would be impossible to express an opinion. Upon this evidence, the jury were of opinion that the deceased was not alive at the time the commission was taken out, but that he had been dead for the whole period of his absence, and the bankruptcy was accordingly superseded.

Taylor commented on this as follows:

period of six weeks. The defendants wished to make it appear that the adipocerous transformation might take place with much greater rapidity, but there were no facts to render this view probable, while there were many facts in support of the contrary opinion.

It seems a reasonable deduction to draw that the time of its appearance is governed first by the general rules which govern the decomposition of the body, and secondly by certain special circumstances which are necessary for decomposition to occur in fats and nitrogenous tissues, at periods appropriate for the formation of the substance in question. Beyond this very general statement it seems impossible to go in the direction of determining with accuracy whether it ever will occur or when it will occur, and we can only record facts as they have been ascertained and which undoubtedly follow within some reasonable distance the above suggestions; thus it is much more speedily formed in tropical than in temperate climates and in hot weather than in cold.

It takes place most readily—(1) *in the bodies of young persons*, the fat being chiefly superficial and very abundant; (2) in those adults whose bodies abound in fat; (3) in bodies exposed to the soil of water-closets; (4) in those immersed in water, but usually less rapidly in stagnant than in running water; (5) in humid soils, especially in graveyards where numerous bodies have been piled in contact with each other.

Devergie has shown that the fat of the female breasts, that of the hollow of the cheeks and other fatty accumulations, are the first to take on this change, *while the fatty layers immediately in contact with the muscles* present no appearance of saponification until a considerably later period.

With regard to the period in an ordinary grave, the case of a female exhumed at Bristol in 1835 after 14 month's interment may be referred to. The lower part of the body was found adipocerous. It appears that the grave was very damp, and the line of adipocerous transformation in the deceased was bounded by the level to which the water had reached.

Our own experiences supported by the experimental conversion of human fat into adipocere suggests that whilst *a slight change in the fat may be observed after about three weeks' immersion in the water, about three months at least is required to obtain definite conversion in an adult limb.*

As a curiosity in the formation of adipocere, it is worth recording that Billroth removed "the fruit of an extra-uterine pregnancy" *perfectly* converted (bones and tissues) into adipocere, every part being entire. The woman was believed to have been pregnant two years before the operation was performed.[1]

To conclude the subject it is obvious that if a medical witness is asked a question on the probable date of death, as judged by the amount or distribution of adipocere, his answer must not be didactic; he can only consider the conditions to which the body has been exposed and then reply that the condition found would (or would not) seem, according to reported cases, to be consistent with what might be expected for the time during which the body has been exposed to the known influences.

Recent experimental work suggests that for rapid adipocere formation, bacterial liberated fat-splitting enzymes must be well distributed through the body, before the body has cooled sufficiently to prevent bacterial multiplication. Though moisture is essential for the transformation it must be remembered that the body itself contains a quantity of water which can be

[1] *Billroth, 1880, Brit. med. J., 2, 897.*

utilized provided that putrefaction is retarded. We have found that burial in sand is ideal for experimental production of adipocere provided that the sand is regularly moistened.

Mummification

Mummification is the dehydration of the body constituents. Without moisture putrefactive organisms cannot proliferate and therefore a warm dry atmosphere, preferably with a free circulation of air around the body, is ideal for mummification. These conditions are met with when burial occurs in the hot arid sands of a desert for there the dry hot atmosphere and the loose sand combine to produce rapid dehydration of the tissues. In this country mummification is unusual in adults, as the conditions necessary for it are rarely present. The mummification of infants, however, is by no means unusual. Newly born infants are commonly concealed in warm dry places, and as their tissues are usually free from organisms at birth they do not go through the normal early putrefactive changes. Occasionally a body which shows evidence of mummification in certain parts may show adipocerous change in others. Thus there may be found some adipocere in the cheeks, abdomen and buttocks, and mummification of the arms and legs. This is accordance with the observations above. It is frequently found during exhumations of bodies buried without coffins; it may, however, happen equally well in the open, as shown by the following cases.

Harry T., aged 42 years, was found hanging from a tree in a wood in late November, having been missing for nine weeks. All the internal organs had been liquefied by putrefaction and had run out of the body through the pelvis. Adipocere had formed over the chest and abdomen, and analysis showed that the adipocere contained 80 per cent fatty acids. There was mummification of the lower arms and lower legs.

[1] In *R.* v. *Sangret*, (Kingston Assizes, 1942) the body of a girl, missing for 5½ weeks, was found buried in a shallow sand-and-gravel grave on a heath near Godalming. The right hand, which protruded slightly on the surface of the soil was mummified, and adipocere was appreciably well advanced in its formation in both breasts and on the thighs. The late summer period when these changes had taken place had been marked by warm sun and intermittent rainfall.

[1] Simpson, K., 1944. *Police J.*, 17, 212.

APPARENT DEATH: PREMATURE BURIAL

CASES have occurred in which persons suffering from concussion, electro-cution, or *apparent lifelessness from exhaustion, from exposure, grave shock,* or severe illness, have been pronounced dead by untrained persons merely because there happened to be inanimation, coldness of the surface, and no outward signs of respiration or circulation. Even the doctor may commit the same grave error.

In 1950 one of the authors was at work in a London hospital mortuary when the body of a woman aged 75 was brought in, stripped and laid on the table. She had been found, cold and apparently lifeless, lying on common ground some 20 minutes previously. A doctor, summoned into the ambulance from the casualty department, had placed a hand on her chest and felt for her pulse and pronounced her dead. Some four or five minutes afterwards faint breathing movements were visible in the epigastrium and stethoscopic examination revealed a heart beat: she survived two and a quarter hours, dying of coronary thrombosis and myocardial infarction.

Apparent Death in Recent Drowning, Hanging and Electrocution. In cases of drowning in particular, it is often difficult to decide whether death has taken place. *Coldness and stiffness of the body in the drowned should not prevent the application of means for the restoration of life.* One or two hours may elapse before signs of animation appear, and in one *instance a* drowned person was not restored until the means of resuscitation had been applied for eight hours and a half. There is reason to believe that some persons removed from water in a state of apparent death are allowed to die owing to want of timely resuscitation and a want of perseverance in the treatment. The continued coldness of the body and the absence of any evidences of success after a few minutes are commonly taken as sure signs that the person is really dead. There appears, however, to be in some cases, if pulled out of the water or suffocating medium, or cut down before stiffness is apparent, a lingering vitality about the body, and some caution is required *in* pronouncing that a person is really dead, since it at once discourages the efforts of those who *are employing means of resuscitation, which should never* be relaxed under at least an hour. If, however, the body has been under water for half an hour or longer, or if it has been found *hanging* or in a suffo-cating medium and is cold and rigid, there can be no hope of resuscitation: commonsense would indicate the uselessness.

After electrical shocks the body may present every appearance of death, but many lives have been saved by the perseverance with artificial respira-tion for long periods.

Apparent Death in New-born Children. In new-born children it is sometimes difficult to determine whether life has or has not ceased. Respira-tion and circulation are carried on in such a tranquil manner in an apparently lifeless body that, except by the presence of some degree of warmth and the

absence of rigidity, the child might be pronounced dead. Cases are elsewhere recorded in which children have survived birth for six, and even 24 hours in this state of inactive separate existence.

PREMATURE BURIAL

There is something terrible in admitting the possibility of premature burial. *Forty-six* cases where premature burial is alleged to have taken place, are recorded by Fontenelle, either of the interment of the living or of apparent death being mistaken for real death. From a careful examination of all these cases, it is plain that the greater number if not all of them are derived from sources which render them inadmissible as evidence of what Fontenelle so strenuously endeavoured to prove. He has collected these cases from every source, whether scientific or not, from the time of Plutarch downwards. This very circumstance would make reasonable men distrust those instances of supposed death which are undoubtedly authentic, even if the facts were not explicable on the most common physiological principles.

"Shortly after the great cholera visitation of 1866 Dr. Filippo Pacini, professor of anatomy in Florence, called attention to the subject in a memorable paper. He cited not a few cases in which the patient, certified dead, had come to life on his way to the cemetery, and he started the not unnatural, if horrible, inference, that the resuscitation referred to may in several instances have come about within the grave itself. To such an extent was this fear of premature burial been carried in America that an association, called the 'American Society for the Prevention of Premature Burial', was actually started".[1]

There is no authenticated case on record in England of premature burial that will stand examination, and in the present state of the law as to certification and disposal of the dead there is not the slightest possibility of premature burial.

At present, in England, the *cause* of death must be certified, and a dead body cannot be disposed of except upon the certificate of the registrar (or upon an order of the coroner). The medical attendant, however, has it in his power to give the certificate without seeing or examining the body of the deceased. Hence arise the possibilities of error, irregular practices, insurance fraud or even crime, all of which would be prevented if the medical man were compelled to view the body after death, and to state that he had so viewed it and that the dead body was that of the person whom he has attended during life. If this were the law it would then be very difficult to certify the wrong body, or bury a person who had been murdered as one who had died a natural death, or a coffin full of heavy rubbish as the body of a human being.

A doctor gave a death certificate for an "old lady" he had been attending in a three storey house: the girl who had called at the surgery had merely said "the old lady's dead". In fact there were two old ladies in the house: the girl was reporting the death of a relative on the third floor—but the doctor assuming her to mean the "old lady" on the second floor (whom he had visited) issued a certificate for a woman who was still alive.

Where by mistake or by intentional misstatement a medical practitioner is induced to believe that a patient is dead of natural causes, a death certificate given by him may be used to conceal crime, as in the following cases:

[1] *Vide Lancet*, 1900, 2, 752.

A woman whose child of seven months had suffered from bronchitis (for which a doctor had attended three days previously) presented herself at the surgery asking for a death certificate. The doctor who would not certify without seeing the body of the child noticed some fresh bruises on the face. He was dissatisfied with the mother's explanation and referred the death to the Coroner. Autopsy revealed 15 fractured ribs and crushing chest and abdominal injuries. The mother who admitted that she had caused the injuries was charged with murder and convicted of infanticide. (*R.* v. *Cattermole*, C.C.C., 1939).

"An old man had a daughter who became engaged to a worthless scoundrel. The latter murdered the old man, and sent his *fiancée* to a physician for a bottle of medicine with the tale that the old man had severe bronchitis. Next day the girl called on the doctor and said that the old man had died, and asked for a certificate of death from bronchitis. This, the doctor, knowing the old man to have frequently suffered from bronchitis, granted, and only chance prevented the crime from being hushed up."

If the certifier were required to see and to identify the dead body, the opportunities for the misuse of a certificate would be reduced to a minimum.

Under the Births and Deaths Registration Act, 1926, which came into force in July, 1927, the practitioner is not obliged to view the body before giving a certificate, but he must state in the death certificate whether he saw the body after death and how long before death he last saw the deceased alive. Registrars have been instructed to refer to the Coroner cases in which a certificate has been given by a medical practitioner who has not seen the body after death or who has not been in attendance within 14 days before death. No doctor should ever take the risk of issuing a certificate unless he has actually seen and identified the dead body.

INFERENCES TO BE DRAWN FROM THE EXAMINATION OF A DEAD BODY—APART FROM THE CAUSE OF DEATH

It frequently happens that the exact cause of death is of less importance in helping the ends of justice than the deductions which can be drawn by a skilled medical jurist from the circumstances surrounding an unknown dead body. Having reviewed the signs of death, with the changes resulting in the body from death, we must now go back to consider some of the problems which may be solved relative to the body, by general observation of the changes we have described.

Deductions as to bloodstains or wounds will be considered under those headings. Here we shall proceed in the following order;

Deductions to be made from the position of the body (a) from its posture (b) from hypostases and blood clots.

Inferences as to the time of death (a) before decomposition has commenced; (b) after decomposition; (c) from bodies putrefied in water.

Decomposition simulating the results of disease, poison, or violence.

Inferences from the Position of a Dead Body as to Interference at or after Death

From its Posture. The postures in which the bodies of persons found dead from any cause are discovered may, in numerous cases, be brought forward to support a charge of murder, or, at least, of criminal interference.

Great care is always required in the application of medical principles to the elucidation of these cases, as well as a good general acquaintance with the various phenomena immediately preceding and following death. The significance of cadaveric spasm has been discussed on p. 183.

A girl found dead on an allotment on the outskirts of Canterbury in 1946 lay on her back, with her legs wide apart, the clothing disordered, strangled. Such posture suggested the possibility of rape. On drawing aside the coat and frock, fresh blood was seen trickling from the vulva; no knickers were present and the torn remnant of a brassiere was found dragged away under the right arm. Death was due to strangulation by the hand. Upon further search the knickers were found discarded a short distance away. Subsequent examination proved that rape had taken place. (see Fig. 20).

Fig. 20. Murder by strangling during the act of rape. The significance of the lie of the body, the position of the disordered clothing and of discarded personal articles must on no account be overlooked. It forms important evidence of the circumstances and nature of the assault.

whether, in a case of violent death, a sound inference could be drawn as to foul play. A question of this kind arose in the case cited below.

In the Rouse Case[1] the body of a man whose identity was never established was found in Rouse's burnt-out car lying face down across the front seats, the head on the driver's seat, the left arm and leg doubled under the trunk, the right leg stuck out through the gap where the near-side door had been. Spilsbury formed the view that this door had been open when the body had either collapsed or fallen through on to the front seats. There was evidence of the clothing being soaked in petrol before the fire.

A "pugilistic attitude" is often adopted by the dead body as a result of intense heat contraction of the stronger arm and leg flexor muscles. It bears no relation to the position at death.

Again, if a body is removed during the state of rigidity, then, in some instances, the fact that it was so removed after rigidity had set in may be indicated by the position of the still rigid limbs not being adapted to the surface on which the body is found lying. It has been already stated that the first effect of death, in the absence of cadaveric spasm, is relaxation of the muscles; the body then disposes itself according to the surface on which it happens to be lying; the arms or legs may be more or less fixed or contorted, or become rigid in the position which they assumed by gravitation at the time of death. The lower jaw, if left to itself, drops and becomes rigid in this position. When

R. v. Rouse, Northampton Assizes, 1931.

Whether this was a case of death from natural causes, or, as alleged, from an injury to the spinal cord, we must regard the attitude in which the body was discovered as very unusual. Had a proper examination been made by medical men when the body was first discovered by the neighbours, some of these difficulties would probably have not existed.

While rigidity, in peculiar positions, may sometimes indicate murder, or some form of violent death, by fixing the body in a position which it could not naturally have assumed, and which cannot be easily altered during the rigid state, we must beware that we do not give an undue importance to this sign of death as a proof of violent usage. This caution is especially required in the cases of drunkards, for the body of a person who dies in a fit of drunkenness may be found contorted and arranged in a way which might be apparently incompatible with either accident or suicide.

From Post-mortem Lividity (hypostases). We have already noted that hypostases form in the most dependent parts of the body, and also that they may be disturbed by the gases of putrefaction, and that they may be observed internally as well as externally. Hence, it is possible by noting the position of the hypostases and also the position of the dark (cellular) part of a large clot of blood—in heart or aorta, for instance—to tell whether a body lay on its face, or back, or side after death, and also whether it has been moved since death.

It will probably, but seldom, happen that such moving of a body is of importance, for bodies are almost invariably moved to a mortuary of some sort before inspection, but in the cases of bodies found under suspicious *circumstances notes should be made of these points, for it frequently happens* that little-noticed points become of great importance at a later stage.

An infant said to have been found dead in its cot face upwards was found—*though still face up on the mortuary table*—to have pronounced livid stains over the face, front of the chest, trunk and thighs. Marks as from bedding were set in relief against these plum-coloured stains; the child had obviously died, and lain dead for some hours, face down. The parents later admitted telling an untrue story—in the *desire to avoid criticism. There was no real suspicion of any deliberate criminal act.*

as already indicated (Chap. V), far easier to achieve accuracy when the body is still fresh—and preferably still warm. Apart from the information to be obtained from the rate of cooling and the onset of rigor in the muscles the observer should keep in mind the possibility of acquiring information from the various biochemical changes which occur in the tissues and fluids of the body, and make such tests as appear appropriate. Schourup[1] has suggested that the changes occurring in the cerebrospinal fluid may be of value in supporting an opinion derived from other sources (see p. 178).

In *R. v. Heath* (C.C.C., 1946) the nude body of a girl was found bound, (recently) gagged and died of asphyxia, in a Notting Hill Gate Hotel. The rectal temperature at 6.30 p.m. on the day the body was found was 84° F (room 63° F). Bearing in mind the temperature in the closed room and the nature of the covering, namely one sheet, it was estimated that about 18 hours had elapsed since death, the murder having taken place around midnight the previous night. Heath had, in fact, arrived at the hotel with the girl at about 12.15 a.m.—and was heard to slam a door (in leaving) at about 1.30 a.m.

In *R. v. McKinstry* (C.C.C., 1942) a girl's body had been found at 8.30 a.m. on the foreshore of the Thames under a parapet of the newly constructed Waterloo Bridge. A police surgeon certified death and (after placing a hand on the body) expressed the view that death had occurred four to seven days previously. In fact, on autopsy at the mortuary at 2.30 p.m., a rectal temperature of 47° F was measured (air 38° F, Thames river 31° F). Bearing in mind the immersion and exposure at night it was estimated that death had taken place around 11.30 p.m. the previous night. McKinstry was seen to leave a local public house with Peggy Richards, the murdered girl, at 11 p.m. and to walk towards the (then) deserted Waterloo Bridge.

See also the "Tow-Path Case" (p. 172).[3]

In these two cases the possibility of a rising temperature at death from asphyxia was considered. This is, indeed, possible in any sudden cerebral disturbance—natural or traumatic haemorrhages, especially pontine, ruptured aneurysms or tumours and the like.

A girl left strangled and suffocated in bed at the Old York Hotel, London, was found to have a rectal temperature of 99.4° a little over three hours after her boy companion for the night had stumbled blindly out of the place.

Bodies lying dead in a hot bath, under bedding (with hot bottles) or heavily padded with clothing offer particular difficulty in forming such estimates. The general factors concerned are discussed in Chapter V. One other question has been raised from time to time: it has been suggested that when the body has lost blood rapidly at (and after) death the temperature is much lowered, but this is not true.

Finally, warning must be given against assuming that the time of an assault and the time of death are necessarily the same. Some hours may elapse before death ensues from even the most grave *looking* wounds, and some assessment of the period may be possible from the site (or amount) of bleeding. To take two extremes, intra-bronchial bleeding is likely to prove fatal in minutes if free, whilst extra-dural bleeding must take, as a rule, some hours—during which the classical "lucid period" may intervene.

In many cases of murder and suicide, such as the following, the murderer is clearly pointed out by the differences in the condition of the two dead bodies when first discovered. The temperature is an important guide in this respect.

A man and his wife were found dead in bed, the bodies covered in blood from wounds inflicted on both. The woman had a deep incision in the throat, besides a

wound under the chin, and another on the side of the head. The man's throat was also severely cut; the razor with which the wounds had been inflicted was found on the bed, within a short distance of his right hand. The body of the woman was cold and rigid; that of the man was warm.

The nature and direction of the wounds, and the marks of violence on the woman's person, suggested that she was the victim of an attack, and the condition of her body showed that she had been dead many hours. On the other hand, the wound in the man's throat was such that he could not have long survived its infliction. As his body when found was warm and pliant, it was a reasonable inference that the wife had died first, and from wounds inflicted by her husband; no other person had access to the house.

In forming a judgment of priority of death in such cases, the sufficiency of the wound to produce instant or rapid death must always be taken into consideration. A person may inflict on another a slight wound which may prove fatal by hæmorrhage only after some hours, while he may afterwards inflict upon himself a wound which would instantly destroy life. In such a case the body of a murderer would be found cold, while that of the victim, by reason of the death being more recent, would be warm.

The stiffening of muscle may be used as a means of assessing the time of death, but it must be recognized that it is very uncertain. As explained already (p. 179) it may develop and pass away with striking rapidity or may be unaccountably delayed. Freezing may hold it in check, stiffening the muscles artificially, and heat stiffening may obscure it. In the ordinary course of events it will commence at about three to five hours in the face muscles, pass into the body, arms and legs and become generalized by 12 hours. It is likely to persist for some 12 hours and then pass away in the same order. The temperature measurement affords a far more accurate means of estimating the lapse of time.

Reference must also be made to one other important condition affecting the changes in the body prior to putrefaction. Where the air temperature remains low or high—and especially where there is a current of air, the progress of decomposition is appreciably—sometimes indefinitely—delayed. Mummification may gradually develop.

In the case of a man of 55, dying in his chair on the first floor of a coffee shop in Bethnal Green, the body, after four months from December to April, showed drying but no decomposition. White moulds covered the exposed skin of the face, neck and shoulders. The condition did not alter appreciably during the three days elapsing before burial.

stated that he went into the boy's bedroom about 6 a.m. and found the boy dead, his body cold, and his arms stiffening: he suggested that he might have died from natural causes. It was proved that the prisoner was heard beating the boy up to 11 30 p.m. on the previous night. As the body was cold when found, and rigidity was commencing, there was a strong probability that the boy must have been dead at least six or seven hours, and, therefore, at a time when the prisoner was last known to have been with him. The body was well developed and covered with bedclothes.

In *R. v. Doidge* (Bodwin Assizes, 1862) medical evidence derived from the state of the dead body when found tended materially to corroborate the circumstantial evidence *against* the accused. The deceased was last seen alive at 10.30 p.m. He was found about 9.30 the next morning dead in his house, lying on his face with his clothes on. He had received severe head wounds, which must have proved speedily fatal. The body when found was quite cold, and the limbs were rigid. The medical evidence was that the deceased had been dead from eight to ten hours.

The prisoner was connected with the act by a chain of circumstances. He was seen drinking and conversing on friendly terms with the deceased at a beershop the evening before. At midnight a neighbour heard two persons in conversation in the deceased's kitchen. One voice he recognized as that of the deceased, and the other as that of the prisoner, with which he was well acquainted. He was soon afterwards suddenly awakened by a noise like that of a heavy fall proceeding from the deceased's kitchen, in which the dead body was afterwards found. His evidence was corroborated by that of his wife. Contrary to his usual practice, the prisoner did not return home until one o'clock in the morning; and then, in order to account for his return at so late an hour, he made a statement which was proved to be untrue. The coldness and rigidity of the body when discovered at 9.30 a.m., and the fact that the deceased was in his clothes, were themselves quite consistent with death soon after twelve o'clock at night, or about the time when a heavy fall was heard by the neighbour. Other circumstances left no reasonable doubt of the prisoner's guilt, and he was convicted.

Inferences as to Time of Death from Digestion of Food. The state of digestion of the contents of the stomach and bowel may be used as an additional means of fixing the hour of death in relation to the last meal. Most elaborate tables have been prepared of the time taken by the stomach to digest certain articles of diet but these are to unreliable to be of use. The rate of digestion varies in different persons and according to the functional efficiency of the gastric mucosa. Gastric and intestinal activity is much retarded in cases of coma and insensibility. Death does not at once cause the process of digestion to cease—indeed the stomach may digest itself after death. Therefore, evidence from this source must be treated with great reserve.

flanks—was pale and little altered elsewhere. Other evidence showed both had died together.

In *R.* v. *Gribble* (Bedford Assizes, 1916), where a murdered boy of 19 had lain for nine days in a hot August sun on a ballast siding, the parts of the body exposed to the air were reduced to a disintegrating mess of maggot riddled tissues. From the waist down to the feet which was protected by the clothing, the changes were more like those to be expected in eight to ten days in the summer.

It has been elsewhere stated that putrefaction does not commonly commence until about the third day after death; but there are many instances known of it commencing almost immediately after death and proceeding with great rapidity:

Clostridial gas-forming septic abortions are notorious in this respect, developing a septicæmia which distributes the organism to the tissues before death.

The body of a woman admitted to hospital the night of her death was noticed to be rapidly becoming "dusky" and somewhat yellow as she spent her last three or four hours. She was placed in the cool mortuary on her death at 8 a.m. and brought out for autopsy at 5.30 p.m. By this time she was developing blood-tinged blisters in the skin, had become purple, almost black in patches and was tense with gases. She had died of a clostridial gas-forming bacillary infected abortion—no doubt with final septicæmia. The intima of the blood vessels was plum-coloured throughout, and the blood "laked." On would have judged her to be dead three to four days at that (September) season. She had a fulminating Cl. Welchii septicæmia from a criminal abortion.

The same conditions are true of other coarse or widespread infections by putrefactive organisms as, for example, in intestinal obstruction, in septicæmias from infected wounds and the like.

A man died at 10 p.m. in November after an accident in which he sustained crushing internal injuries. At 11 a.m. next morning, though only 13 hours had elapsed, the body was so bloated and putrefied, the face so swollen and discoloured, that the jury could not be asked to approach the body for identification purposes.

A man, aged 50, died from an accident in December. He lost much venous blood, and, without showing any sign of rallying from the accident, died on the fourth day after his admission. The man died at 6 p.m., and in an hour or two his body was carried to the deadhouse. The weather was frosty, and there was a hard frost during the night on which the body lay in the deadhouse. On the following day (only 20 hours after death) putrefaction had advanced to such a degree that deceased could scarcely be recognised. The skin was throughout distended by gases of putrefaction. All the viscera were decomposed, the liver contained putrescent gases, and even the coats of the gall-bladder were distended with them. This was a case of rapid death, probably from blood-poisoning.

In these cases the effects of the gas-forming and hæmolysing organisms are clearly seen, and such cases could be multiplied indefinitely. The condition of these bodies in reference to the process of putrefaction is such as Devergie assigns to dead bodies at a period of six to twelve days after death, on the assumption that they have been freely exposed to the air at a mean temperature. Had the body of such persons been found in a house in these conditions, and had the history of the case been entirely unknown, a medical man, asked to assign a period of death from common experience in such matters, might have declared it to be impossible that the deceased could have been living within 24 hours previous to the discovery. Suspicion might thus be removed from persons really guilty of murder, because it might be proved that they had not been in or near the house until within a day of the discovery of the body. On the other hand, an innocent person who had been seen in company with the deceased five or six days previously, might be unjustly charged with having been accessory to his death. Caution is required

in expressing a medical opinion on the time at which death took place in bodies which are found much decomposed.

Upon burial decomposition is retarded to a remarkable degree.

In *R. v. Gordon* (Maidstone Assizes, 1950) a child's body was found buried in a shallow grave (head 12 inches, feet 6 inches deep) in a wood outside Canterbury on April 24th. It had disappeared on April 15th, and enquiry later revealed that following chastisement inflicted by the foster-father it had "been found dead in bed". He had feared punishment upon enquiry and had buried it. After ten days burial (April) the conditions were as if it had died 30 to 36 hours previously.

Mant[1] has had an unusual opportunity of observing the variations of change after burial whilst on service for the War Crimes Commission in Europe at the end of the 1939–45 war and formulated the following general factors affecting the changes taking place after burial:—

1. The physical condition of the body.
2. The time lapse before burial—during which ordinary putrefying change may commence, flies may lay eggs and maggots may emerge to hasten disintegration of the tissues.
3. The clothing—any covering tending to retard decomposition (and promote adipocere).
4. The type of coffin—especially as to its permeability to water.
5. The depth of burial and type of soil: deeper and well drained burials deteriorate more slowly.
6. Access of air in shallow graves hastening decomposition.
7. Mass burial: contact with other bodies delaying the process.

(e) From Bodies Putrefied in Water

The principles governing loss of heat and rigor mortis in water have already been discussed (p. 167). Some attempts must be made to generalize on the phenomena of putrefaction in winter in order to enable us to say for how long a period a body may have been immersed. No satisfactory data, however, have been obtained to guide us in this inquiry[2]. The changes which take place are modified in their degree and the rapidity of their progress by numerous and often inappreciable causes. Devergie believed that he could determine with some precision the length of time during which a dead body may have been in the water, *supposing the drowning to have occurred during the winter season*. Thus, according to him, in bodies immersed *from three to five days* we shall find:—Cadaveric rigidity; coldness of the surface; no contraction of the muscles under the galvanic stimulus; and a white or sodden appearance of the skin of the hands. From *four to eight days*: —Pliancy of all parts of the body; no muscular contractions under the galvanic stimulus; natural colour of the skin; cuticle of the palms of the hands very white. From *eight to twelve days*: —The whole of the body flaccid; the cuticle of the back of the hands beginning to whiten; the skin of the face softened and pallid, differing from the skin of other parts of the body. About *fifteen days*: The face somewhat bloated[3] and covered with red patches; a greenish tint in the middle of the

sternum; the cuticle of the hands and feet perfectly white, and becoming raised in folds. About *a month*:—Face of a reddish brown colour; eyelids and lips green; a reddish brown patch surrounded by a green border on the fore part of the chest; the cuticle of the hands and feet white, thickened, and corrugated. About *two months*:—Face brownish-coloured and swollen; the hair becoming loose; the cuticle of the hands and feet in great part detached; the nails still adherent. *Two months and a half:*—Cuticle and nails of the fingers detached, the cuticle of the feet detached, but the nails still adherent; partial saponification of the cheeks and chin, superficial in the breasts, groins, and fore part of the thighs. *Three months and a half:*—Destruction of part of the scalp, eyelids, and nose; partial saponification of the face and the upper part of the neck and groins; destruction of the skin in different parts of the body; cuticle of the hands and feet as well as the nails entirely detached. *Four and a half months:*—Almost complete saponification of the fatty parts of the face, neck, groins and fore part of the thighs; the appearance of a calcareous incrustation or deposit on the thighs; opalescent condition of nearly the whole of the skin; destruction and removal of the hairy scalp; *the bones of the skull laid bare* and beginning to become brittle. There are no data to give even approximate opinions for a longer period than this. In subjects drowned during spring and summer these changes take place at rates about three and six times as rapid respectively. At the height of summer the body will float at two days and bloat in three.

In attempting to fix the time of death from the extent of destruction of the parts, a pathologist must remember that crabs, eels, etc., attack the body within an hour or so of immersion, and may remove most of the exposed soft parts in a few hours. Below the "salt-divide" of the Thames, bodies are seldom found after the first two days have elapsed.

In those who are drowned during winter, and whose bodies remain long below the surface, or are covered with mud so as to prevent free access of air, decomposition takes place slowly and crab digestion is less active.

A man found in the sea off Portobello after 12 weeks' immersion showed the skin fairly intact, but loose and discoloured, distension of the abdomen, and a fairly good state of preservation of the internal organs. In the body of a man immersed for five months in the sea the cheeks and remains of the scalp were transformed into adipocere, but the rest of the body was practically intact.

A man aged 70, was missing from January 6th to February 4th. His body was found in a river, and there was reason to believe that he fell in and was drowned on the day when he was last seen. The head, neck and a portion of the chest, where unprotected by clothing, were thickly covered with mud. When this was removed, the features were perfectly recognisable, and although 28 days had elapsed, identification was easy. The only changes observed were as follows: The cuticle peeled away from the cutis when slight friction or pressure was made over those parts which had been covered with mud. The face and neck were somewhat darkened in colour, and the front part of the chest was marked with slight lines of lividity. The thickened skin of the hands and feet were corrugated and whitened by long continued immersion, but remained firmly adherent to the tissues beneath it.

Taylor had once to decide, in reference to a woman delivered of a child 18 months previously and suspected of murder, whether it was possible that a human body could remain so long a time as 18 months in water without being totally destroyed, and, further, whether the action of water would not increase the bulk of the body, so as to make a new-born child appear some weeks old. The answers to these questions were (1) that a dead human body submerged is not necessarily destroyed in 18 months: and, in reference to this case, it appears probable from the description that the body had been

immersed for a longer period; (2) that in the early stages of gaseous putrefaction the body may appear larger from gaseous distension, but age could best be decided from the state of the ossific centres. There were no data to determine whether the child had been placed in the water living or dead.

The following is a remarkable instance of the effects of water on the human body after submersion for the long period of 26 years:

A healthy muscular man, aged 24, fell into the shaft of a mine 300 feet deep, of which 180 feet consisted of water: efforts to recover the body were unsuccessful. The shaft was closed over for 26 years, when working was resumed. The skeleton of the missing miner, with portions of the clothes which he wore, was discovered in one of the levels, in which there was water. The remains, as well as the clothes, buttons, and boots found on the skeleton, were identified by his brother. All the soft parts, with the exception of a small piece of fatty substance, were destroyed, but the bones were firm and well preserved. There was no muscle, tendon, ligament, or even cartilage about any of them. They were all detached from the joints, and were of a dirty brownish or almost black colour. There was nothing in the water calculated either to destroy the soft parts or preserve the bones. (*vide* the case of the Tollund man, buried in a peaty soil for 2,000 years (p. 54)).

A precise opinion is not infrequently required of a medical witness respecting the probable period at which death has taken place from drowning, as upon the recovery of unidentified persons or of suicides last seen on given dates In the case of *R.* v. *Whiteway* it became a vital part of the case for the Crown to say at what *hour* the victim just recovered had died, and on what *day* the second (*vide* p. 172).

Post-mortem Conditions Simulating Disease, Poisoning or Injury

Brief reference to some of these has already been made in the systematic description of *post-mortem* changes:—

   (a) Hypostases (p. 173) simulating bruising or inflammation or poisoning (p. 174).

   (b) Blebbing of the cuticle (p. 188) simulating scalds and burns.

   (c) Swelling, detachment or splitting of the skin simulating injury.

   (a) **Hypostatic stains** in the skin are often patchy in their development and may thus cause local discolouration simulating bruising and requiring incision for their differentiation. In bodies hanging for some hours the hands and feet may become profoundly discoloured. On the hands and feet the colour of the interosseous muscles may cause a similar uncertainty. Incision at once makes it clear whether or not there has been an escape and infiltration of blood into the tissues, for this has a distribution outside the vessels and does not drain away upon incision. Lividity lacks the œdema of inflammation and causes no swelling of the parts: if there were doubt microscopy will settle the issue.

   Hypostasis in the stomach or bowel is more often a source of perplexity or error. In dead bodies various discolourations take place in the stomach and bowels, often closely simulating the effects of poison.

with the other parts of the bowel. They were, in fact, merely turgid from hypostasis. Autopsy revealed a coronary thrombosis—and analysis was negative.

The mucous membrane of the stomach may vary in colour from a red-brown, becoming a brighter red by exposure to the air, to a deep purple or slate colour, and sometimes black from decomposition of the blood. At the points where the stomach is in contact with the spleen or liver the lividity is often well marked and clearly defined through all the coats. These spontaneous changes, which are the result of putrefaction, may be easily mistaken for the effects of irritant poisoning. There are no rules that will always enable a medical jurist to distinguish such cases. Much must depend on the period after death at which the body is examined, and especially on the experience and acumen of the pathologist. We may presume that the redness has taken place during life, and is not a result of *post-mortem* changes: (1) when it is seen soon after death; (2) when it is met with in parts not dependent, nor in contact with other organs gorged with blood; (3) when it is accompanied by a considerable effusion of coagulated blood, mucus, or flakes of lymph, the result of ulceration, corrosion, or destruction of the coats of the viscera; (4) if decomposition has not advanced too far, an effort may be made to strip off the mucous membrane of the stomach; if it separates readily, this is suggestive of irritant poison. If death has been preceded by severe vomiting from *any* cause, small submucous hæmorrhages may sometimes be seen, so that their presence is not necessarily indicative of an administered poison. When the body is not inspected until a long period after death it is difficult to distinguish these pseudo-morbid appearances from those depending on the action of irritant poison. In a really doubtful case it is therefore better to withold an opinion and indulge in analysis for security.

It must be remembered that the contents of the stomach may be of more importance than its condition. If the irritation is due to mineral irritants, it is practically certain that traces of the substance will remain. Vegetable irritants (bits of leaves, berries, flowers, etc.) are likely to be recognized, though naturally liquid preparations of irritants of any kind may have disappeared.

It is impossible to assign a definite time at which the effects produced by irritant poisons are destroyed by the process of putrefaction. On one occasion the effects of arsenic on the mucous membrane of the stomach were distinguishable in the case of a child whose body had been interred for a *period* of 28 days, and in two other cases, in which the viscera were well preserved, they were so after a year and 19 months respectively. Of course, when the inflammation is only slight, its results will be much more speedily obliterated, or merge in the redness caused by decomposition.

Again, melanosis in the stomach—i.e., a deposit of black colouring matter beneath the mucous coat—might be mistaken for the effect of sulphuric or oxalic acid or caustic alkalies; but melanosis is unaccompanied by any marks of inflammation, corrosion, or destruction in the mucous membrane beneath, and it is always seen in well-defined spots.

(b) **Blebs** found on the cuticle due to putrefaction are always accompanied by a characteristic purple or green colour which distinguish such *post-mortem* blisters from those due to the application of heat in life. Many cases are seen, especially in the elderly, where bottles applied at the end of life cause reddening and simple pink blistering. Microscopy will distinguish the vital cellular character of an inflammatory or traumatic lesion, but it may be exceedingly

difficult to tell how long before death they were sustained. Comparitively slight heat will cause blistering in those whose circulation is fading, who have peripheral vascular stasis and whose capillaries are already suffering suboxic.

(c) **Swelling and discolouration** from decomposition is often mistaken for injury. The eyelids or face may swell, discolour a purple or blue-black and look puffy as if they had been bruised. The lips may thicken and discolour in the same way and when blebs are formed and detachment of the cuticle occurs the danger of confusion is even gréater. Incision is still the best immediate test—and microscopy the ultimate basis for distinction between *post-mortem* changes and bruising.

Later the skin may soften, break down and tear with movements of the body. Where blood has accumulated (as in the caput region of the fœtus) this process may be accelerated.

CHAPTER VIII

LEGAL PRESUMPTION OF
DEATH AND OF SURVIVORSHIP

INASMUCH as a person who has been presumed to be dead may possibly reappear and require identification, there is a certain propriety in discussing this subject under the general heading of "Death".

Although the English Courts are called upon frequently to deal with applications arising out of the presumed death of persons who have disappeared in various circumstances, medical evidence is rarely necessary except in certain rare cases.[1]

In cases where a missing person is shown, prior to disappearance, to have been suffering from a serious disease which was likely to prove fatal in regard to which he may have received medical advice, testimony by medical witnesses might assist the Court in coming to a conclusion, by showing the stage to which the disease had advanced, and the probability of its causing death within a certain period. No general rules to govern such cases can be laid down; each case must depend upon the circumstances which accompany it.

The presumption of death after the expiration of seven years from the date when the missing person was last heard of is the general rule of law.[2] In the Probate Court, where such applications are frequent, this rule is not recognized as absolutely binding.

The Probate Court does not presume the death of the alleged deceased; but, after hearing the facts, merely gives the applicant leave to swear, for the purpose of obtaining probate or letters of administration, that the deceased died on or since a certain date.

Cases have occurred where the presumed deceased has returned after the Court's decision granting leave to swear his or her death. The following is a case in point:

perished in the explosion. The counsel for the defendants ingeniously argued that as the death of the wife could be fixed, whereas that of the husband could not be fixed, it was fair to assume that she died first; but this argument failed to satisfy the Court. The plaintiffs were not required to prove when the husband died; they established sufficient to render it probable that the wife was the survivor.

For a case where the medical evidence of survivorship in an aeroplane smash was held to be inconclusive, see *Lancet*, 1926, 1, 515.

In *Hickman v. Peachey* (1945), W. N. 153, the House of Lords held that where the evidence was inconclusive the statutory presumption applied.

Death of Mother and Child in Parturition. For a case where a husband and a wife were killed by an explosive bomb during an air-raid, where the evidence was not sufficient to rebut the statutory presumption, see *In re Lindop*.[1]

On this subject Tidy wrote as follows[2]:—

"*Death by Parturition.*—If a mother and child both die in childbed without witnesses, the presumption is that the mother survived the child. For, *first*, there is a *prima facie* probability of the child being still-born, and that a woman in childbed without attention or attendance will be unable to render her child the assistance necessary for its preservation. *Secondly*, a large child, or marks of a difficult labour, or the absence of the signs of respiration would suggest the death of the child as occurring before that of the mother. Thus, from both points of view, the presumption of survivorship in those rare cases where mother and child both die is in favour of the mother.

"We agree with most medical jurists that those who assert that the child survived the mother should be required to adduce definite evidence of their contention. At the same time, it must be remembered that although the child may die from cold, or from suffocation, or from its being of unusual size, or from protracted labour or from labour complicated with convulsions, or from pressure on the umbilical cord, or from partial detachment of the placenta, and other causes, nevertheless the mother runs the risk (and that risk a very dangerous one) of hæmorrhage. Again, it is quite conceivable that a mother might give birth to a child and herself tie the cord, and then *die of syncope from the exhaustion consequent on the effort, whereas the* child would be temporarily safe."

WOUNDS AND OFFENCES AGAINST THE PERSON

THE frequency of the various indictable offences that involve injury to the person and which comprise the substance of the following sections is reflected by the criminal statistics of England and Wales.

Table I
OFFENCES AGAINST THE PERSON (1953)   (Assizes and Quarter Sessions).

	Offences known to Police	Prosecutions.
Murder	131	66
attempt to murder	129	35
Manslaughter	153	89
Infanticide	26	18
Child Destruction	—	—
Felonious wounding	981	544
Malicious wounding	5111	438
Assault	95	85
Cruelty to children . . .	—	28
abandoning (under two years) .	23	1
Procuring abortion	249	53
Concealment of birth . . .	51	16
Unnatural offences	700	328
attempts at ditto . . .	3305	328
Indecency with males . . .	1675	730
Rape	295	102
Indecent attempts on females . .	7917	422
Defilement of girls under 13 . .	231	70
„ „ „ „ 16 . .	1338	303
Incest	326	110

This table merely gives a general idea of the nature of the more common offences against the person. The special character of certain of these, e.g., in cases of infanticide and abortion, rape and other sex offences, will be considered in detail under the appropriate headings, but in the sections which follow below we shall concern ourselves more with the nature and character of injuries in general and with the proper interpretation of wounds of all kinds, however they may have been inflicted.

It is clear that offences of such widely differing nature must include great variation in both the source and character of the injuries sustained. They may be inflicted with widely different instruments in an infinity of ways, may be superficial, penetrating or disintegrating to the tissues involved and demand a consideration of certain general principles before examination of their detail.

The characters of an injury caused by some mechanical force are dependent upon:
1. The nature and shape of the weapon.
2. The amount of energy imparted to the body.

3. Whether it is inflicted upon a moving or a fixed body.

4. The nature of the tissues involved.

The consequences of an injury from some mechanical force depend largely on its violence, the length of time it operates and the tissues injured. The destructive energy liberated when a moving body is suddenly brought to rest is expressed by the formula $\dfrac{MV^2}{2}$ where M = mass and V = velocity of the object. The mechanics of impact is explored in later sections, but it must be clear from this formula that the velocity is much more important than the weight of the weapon used.

We shall discuss in some detail in the sections dealing with the "Cause of Death in Wounds" the consequences of the infliction of injury to the tissues.

ENGLAND AND WALES

DEATHS FROM ACCIDENTAL AND SUICIDAL CAUSES, 1953

From the Registrar General's Statistical Review of England and Wales
(Tables, Part 1, Medical)

Cause of Injury.				Accident.		Suicide.	
				M	F	M	F
Total (all injuries)	.	.	.	9017	5639	3020	1734
Motor vehicle	.	.	.	3342	1033		
other transport	.	.	.	860	99		
Falls	.	.	.	1787	2812		
Machinery	.	.	.	167	5		
Falling object	.	.	.	349	16		
Fire, explosion	.	.	.	220	359		
Scalds, corrosion	.	.	.	71	53		
Drowning	.	.	.	719	194	258	216
Firearms	.	.	.	87	5	208	11
Electrical	.	.	.	86	25		
Heat—or cold	.	.	.	6	3		
Hunger, exposure	.	.	.	14	9		
Choking—food	.	.	.	205	163		
—other foreign bodies	.	.	.	11	3		
Suffocation—in bed, cradle	.	.	.	125	99		
—other	.	.	.	46	3		
*Poisoning	.	.	.	458	474	1608	1278
Hanging, strangling	.	.	.	—	—	531	126
Cutting and stabbing	.	.	.	17	8	195	25
Precipitation (see falls)	.	.	.			74	47
Various other causes	.	.	.	464	284	146	31

* See separate tables, Vol. II.

Reference to Table II detailing the Registrar General's statistics of injury by cause (in accident and suicide) shows, further, the variety of "instrument" and other causes for injury—adding more than mere mechanical factors to their potential for harm and indicating a wide field of enquiry and study which we must now discuss at length.

GENERAL WOUNDS

Legal Considerations

Offences against the Person Act, 1861.

Definition of a Wound—Bruise—Abrasion—Lacerated Wound—Incised Wound—Stab or Punctured Wound—Effusion.

Weapons—Newer definition by Prevention of Crime Act, 1953.

Grievous Bodily Harm.

Wounds

LEGAL CONSIDERATIONS

Offences against the Person Act. 1861: Sect. 11: "*Whosoever shall by any means whatsoever wound or cause any grievous bodily harm to any person with intent to commit murder shall be guilty of felony.*"

Sect. 18: "*Whosoever shall unlawfully and maliciously by any means whatsoever wound or cause any grievous bodily harm to any person, or shoot at any person, or, by drawing a trigger or in any other manner, attempt to discharge any kind of loaded arms at any person with intent, in any of the cases aforesaid to maim, disfigure, or disable any person, or to do some other grievous bodily harm to any person . . . shall be guilty of felony.*"

Sect. 20: "*Whosoever shall unlawfully and maliciously wound or inflict any grievous bodily harm upon any other person either with or without any weapon or instrument shall be guilty of a misdemeanour.*"

Definition of a Wound. The preamble to the *Offences against the Person Act*, 1861, states that. "it is advisable to consolidate and amend the law relating to offences against the person". The Act contains no definition of a wound, but it has been held that, to constitute a wound within the statute, the continuity of the skin must be broken; the outer covering of the body, not merely the cuticle, must be severed.[1] This plainly cannot hold. A division of the internal skin—e.g., within the cheek or lip—is sufficient to constitute a wound within the statute;[2] but it is not sufficient to prove merely that a flow of blood was cause.[3]

A sounder definition, capable of general test is: a wound is a solution of the natural continuity of any of the tissues of the living body.

This definition expressly omits—

(1) Any reference to the effusion of blood, for it is quite possible either to wound or to cause grievous bodily harm to a person without causing the effusion of blood. A wound of the cornea of the eye, for example, may result even in death without spilling of blood; and, in ordinary medical parlance, we speak of abrasions and injuries of the cornea as wounds of the cornea. (*vide supra*).

(2) Any allusion to the skin being severed. Why should the skin be the only tissue in the body the laceration of which constitutes a wound, when in ordinary medical conversation one is constantly referring to wounds of the liver, of the spleen, of the intestines, etc?

[1] *R. v. M'Loughlin*, 8 C. & P. 635.
[2] *R. v. Smith*, 8 C. & P. 173.
[3] *R. v. Jones*, 3 Cox C.C. 441.

3. Whether it is inflicted upon a moving or a fixed body.

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[1] *R.* v. *M'Loughlin*, 8 C. & P. 635.
[2] *R.* v. *Smith*, 8 C. & P. 173.
[3] *R.* v. *Jones*, 3 Cox C.C. 441.

(3) Any allusion to the nature of the tissue damaged. Why should a fractured bone, or a dislocated joint, not be a wound?

(4) Any allusion to the 'cause of the solution of continuity; disease produces wounds as easily as a knife, though not by the same process.

The overwhelming advantages of the definition are that it includes *bruises*, the effects of burns from fire and heat and electricity, the effects of any corrosive liquid or solid, all lacerations and *bruises of internal organs and tissues*; it prevents any possible quibble about the skin being or not being severed; *it makes no reference to how or by what means produced*; it is short and simple, and is constantly being used in professional discussions *in relation to all organs*; it assuredly includes all dislocations of joints and fractures of bones, and rightly so, for they in turn include some of the most severe injuries and "grievous harm" that can be done.

If it be objected that the law did not intend to include slight scratches from finger-nails, pin-pricks, and trivial wounds of this description, it may be retorted, from a medical point of view, that many of these, and especially small punctured wounds from a septic or dirty instrument, are more dangerous to life than many open wounds.

Having thus defined a wound in general terms, it is necessary to define the various kinds of injuries that may be sustained.

A Bruise or Contusion is a blunt wound crushing blood vessels so that blood is effused from the rupture of the vessel and is unable to escape freely from the surface either of the severed skin or of the injured organ. In the case of tissues, such as the cornea of the eye or the cartilages of bone, which have no blood-vessels, a bruise may be similarly defined as a crushing of the tissues *without bleeding. In common language, the terms bruise and bruising* generally refer to the blood which is effused in consequence of the rupture of a vessel or vessels or to the change in the tissues amongst which this blood has spread; they have no reference to the injury which caused the effusion to develop.

A Graze or Abrasion is a superficial injury to the skin: such scratches or scraping injuries bleed but slightly as a rule, and heal readily. Their importance lies in the fact that they are usually corroborative of violence, as, for example, in strangulation or rape, in vehicular street accidents and the like.

A Lacerated Wound is a wound the edges of which are irregular and not clean cut. This term usually refers to injuries from blunt instruments in which the tissues are split open—often against bone.

An Incised Wound is a clean cut through the tissues, usually the skin and underlying connective tissues including their blood vessels. Blood escapes freely through the wound to the surface. Incised wounds have greater length than depth, often tending to gape.

A Stabbed or Punctured Wound is one in which the depth (measured from the surface of the wound) is great in proportion to the length of the entry wound. These are penetrating wounds, often bleeding freely internally.

Extravasation or Effusion. Inasmuch as these two words are frequently used by medical men in describing injuries, it is well to draw attention to their meanings. In our present connection they both mean the same thing, viz., *a pouring out*, and they are applied to the outpouring of blood amongst

the tissues which follows a solution of continuity of a blood-vessel. Custom has to some extent limited the use of effusion to a pouring out of blood into a natural cavity like the pleural sac or a joint cavity. Very small outpourings

Fig. 21. Knife stab wound showing (left) the squared back and (right) the sharp blade mark of a single-edged knife.

of blood—mere "spots" of bleeding are spoken of as **ecchymoses**. For instance, the little spots of escaped blood beneath the pleura in asphyxia are commonly spoken of as ecchymoses or ecchymosed spots (often also called petechiæ). It is advisable for a medical witness to use these terms with great care in giving evidence and use the term bruise only when he wishes to indicate that blood has escaped into the tissues as the result of violence. The subject of ecchymoses is discussed in full both in the section on shock (p. 284) and in that on asphyxia (p. 458).

What are Weapons? Those legal doubts which formerly arose in reference to the true signification of the term *weapon* have been removed by statute. Thus the teeth, the uncovered hands or feet, were formerly held by the judges *not* to be weapons; and injuries produced by them, however severe, were not treated as wounds within the meaning of the statute. Parties were tried on charges of biting off fingers and noses, and although the medical evidence proved that wounds of a severe kind had been thus inflicted, the persons charged were acquitted under an indictment for "wounding", since wounds in a legal sense could be produced only by "weapons". Such assaults would now be dealt with as cases of "grievous bodily harm".

During a trial some years ago the prisoner's counsel claimed for artificial arms and legs the same privilege of exemption that was accorded to natural arms and legs. It was argued that a wooden arm with an iron hook at the end of it, with which an assault was committed, had become, by long use, part of the body of the prisoner, and that, like a natural arm, it ought not to be considered a weapon in law; but the contention was disallowed.

Except in so far as the deliberate use of a weapon may indicate an intent to inflict a greater amount of personal injury, such questions as these cannot now arise.

The variety of articles that may be put to use as weapons is, of course, quite without limit. No statutory definition has been attempted, but the law has, in the Prevention of Crime Act, 1953, prohibited the carrying of "offensive weapons" without lawful authority or reasonable excuse. If has, in Sect. 1. 4., gone so far as to say that "offensive weapon" any article made or adapted for use for causing injury to the person, or intended by the person having it with him for such use by him.

Grievous Bodily Harm. With such a comprehensive definition of a wound, there is very little positive ground left for these words to cover. They might include shocks from electricity which did not burn, tight ligatures

placed around limbs or around the penis, foreign bodies inserted into the rectum or vagina, burns that did not wound (first degree, or mere redness), the throwing of liquids which are not corrosive, merely staining or irritating the skin, and possibly a few other injuries: but with these, as with *wounds*, *the intent with which they were inflicted is of more importance in some ways than the injury itself.*

In *R. v. Davis* a man was charged with wounding with *intent to do grievous bodily harm.* It appeared from the evidence that the prisoner, half drunk, and during a quarrel, suddenly stabbed the prosecutor, inflicting a *dangerous wound,* with which he was laid up for a month. For a fortnight he was in danger. *It was contended that there was no intent to produce grievous bodily harm.*

The Judge said that the jury might satisfy themselves on that point by considering the circumstances of the case. Could a man inflict such a wound without having an intention to inflict grievous bodily injury? The prisoner was not so drunk as not to know what he was doing, and all the circumstances showed premeditation and intention, viz., the nature of the wound, the weapon used, and the part of the body struck, where an injury was so likely to be dangerous. The prisoner was found guilty of the intent. In cases of this description, the intent with which a wound was inflicted is usually proved by *circumstantial evidence.*

In April, 1904, at Market Deeping, in Lincolnshire, an extraordinary event happened in which there was inflicted "grievous bodily harm" resulting in death.

The victim was on the ground with a second person lying on the upper part of his body, while a third passed the nozzle of a force-pump[*] through a hole in the victim's trousers and up his anus, and then turned the stopcock, allowing air to rush into the intestine. On admission to an infirmary the abdomen was highly distended with gas. The lower outlet of the bowel was dilated, and the bowel pushed down into it. A tube could not be pushed either through deceased's mouth or his anus, he was so tightly blown up. He died very soon after the event. The following day a medical witness made a *post-mortem* examination, when he found ruptures of the gut. Eight inches from the outlet there were two rents, one 1½ inches long, and the other ⅞ of an inch long, which might have been caused by the nozzle of a pump. The gut around the vent was gangrenous and congested, which might have been caused by peritonitis, due to the rupture of the gut. There were no marks or bruises on the body of the deceased. The medical witness could not say whether the pipe had been put up the anus.

Several cases of a similar nature, occurring in works where compressed air is used, have since been reported. The force of the issuing stream of air is so great that it is not necessary to have a hole in the clothing for "grievous bodily harm" to ensue.

POINTS TO BE NOTED IN THE EXAMINATION OF WOUNDS

Whenever a doctor is called upon to examine a wound, the following points should invariably be attended to, and recorded *in writing as soon as possible,* the exact date and time of examination being noted:

1. Number and type of wound.
2. Situation.
3. Size, shape, depth and direction.
4. Condition of edges, ends and floor.

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[*] The pump was one of those used to free gas-pipes in winter from accumulations of solid matter. Air is pumped into a chamber at considerable pressure, and is then suddenly released by turning the stopcock so that air rushes violently through the nozzle to force out any obstacle.

5. Foreign bodies attached or embedded—metal, glass, hair, dirt, etc.
6. Hæmorrhage: its amount and source.
7. Inflammatory reaction and healing processes.

Each of these may be of vital importance for drawing accurate conclusions when a medical man ceases to be a common witness of fact, and commences his more appropriate function of giving expert evidence. Each wound must
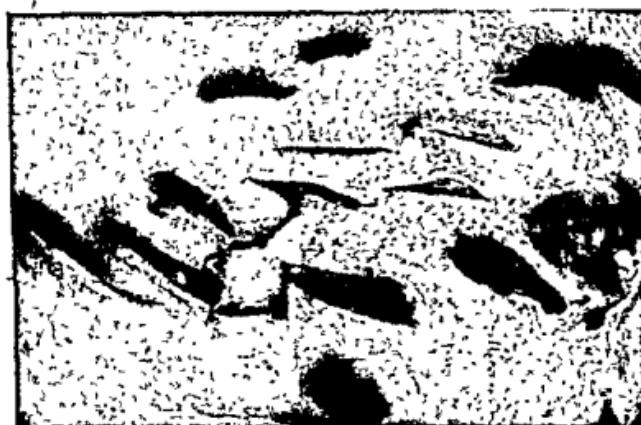
Fig. 22. Eighteen stab wounds inflicted in quick succession into the chest over the heart by a double-edged dagger with a 1 inch wide blade (half size). The variety of wound caused by varying depth of penetration and partial withdrawal as by rocking also, is well illustrated.

be described so that it can be accurately localized and precise measurements of the size, depth, etc., must invariably be taken. A photograph or sketch showing the position and size of the wounds is desirable: the usual medical figures for clinical mapping-out are too small in practice. A scale drawing, or even natural size tracing, often helps to elucidate the issue.

It is impossible to impress too strongly on the mind of a medical witness that in describing the wounds which he has found during the examination of a body he should use plain and simple language, and avoid as much as possible the use of technical or professional terms. The natural desire of a good witness is to make himself understood; but this cannot be accomplished if he expresses his ideas in language which is incomprehensible even to educated men of the legal profession, and *a fortiori* to the more ordinary class of men who constitute juries. To employ plain and simple language in describing a wound and its interpretation, as well as in giving evidence generally, is to present the facts to the best interests of justice.

In medico-legal reports on the examination of wounded persons, care should be taken to avoid the introduction into the body of the report any remarks in the form of inferences from, or comments on, the non-medical facts of the case, and even on the medical facts. Comments and inferences should be carefully separated from the facts. At the trial of McLachlan the Judge objected to the statements in the medical report "that the body of the deceased had been found under circumstances of great suspicion", and "that there were marks of a severe conflict". No medical facts by which this form of expression could be justified had arisen: these were matters—as they always are—which are best set down in a supplementary report, or in answers to specific questions.

Is the Wound Dangerous to Life?

The meaning of the words *dangerous to life* is left entirely to the professional knowledge of a witness. It is not sufficient that he should make a simple assertion that the wound was dangerous to life; he must be prepared to state to the court satisfactory reasons for this opinion; and these reasons may be rigorously inquired into by counsel for the defence.

Danger to life primarily depends upon hæmorrhage, shock or damage to a vital organ; and secondarily on the chance of complications such as infection leading to septicæmia, pyæmia, tetanus or gas gangrene and of infection of particular parts or tissues—pneumonia, pleurisy, empyema, pericarditis, meningitis or peritonitis; or more remotely to the effects of scarring, causing stricture (of the urethra, œsophagus, gut, etc.), paralysis, urinary infection, etc.

As a general principle, the court is likely to consider as dangerous to life in a legal sense only those wounds in which the danger is imminent. The law appears to contemplate the more immediate rather than the more remote possible dangers. If the last view were held, it is clear that the most trivial lacerations and punctures might be pronounced dangerous to life, since tetanus and other infections proving fatal have resulted from very slight injuries. A difference of opinion will often exist among the medical witnesses, whether a particular wound is or is not dangerous to life, but, after all, unanimity can hardly be expected even when the judgment and experience of the witnesses are equal. The rules for forming an opinion in these cases will, perhaps, be best deduced from commonsense and from good surgical authorities on injuries and their risks to life.

Is the Wound Likely to Leave Permanent Injury?

The only connections in which this question can arise are either when considering compensation in cases of accident or when a judge is considering what sentence ought to be passed upon an assailant in cases of criminal injury.

The answer to this question may be obvious in cases in which there is actual immediate loss of eye, limb, or member. In other instances the possibility of permanent damage may depend on the nature of the wound and the possibility of such sequels as sympathetic ophthalmia, possible gangrene from damage to vessels, severe injuries to nerves, amount of inflammation, chances of septicæmia, etc.

Scarring and its effects, producing contraction, keloid, etc.; the effects on muscles, bones and joints leading to stiffening and loss of function, damage to the central nervous system, leading to immediate physical effects or to psychiatric or other lesions less easy to trace to their origin; and lowering of the resistance of the tissues leading to secondary diseases or to malignant growths must also be considered.

Was Wounding Responsible for Death?

In all cases where wounds have been criminally inflicted and death ensues, a medical witness must be most careful in his assessment of their contribution to the cause of death.

No man ought to be convicted upon mere medical probability. As a rule there is only one principal cause of death, although other circumstances may have assisted in bringing about a fatal result. Hence it is essential when several apparent causes for death exist, to determine which was the principal cause, and, in stating it to the court, to be prepared to offer reasons for that opinion. In most cases of local injury, when a person dies quickly, there should be no difficulty in determining whether disease or the wound was the cause of death. There may be difficulty when a person who has recovered from the initial effects of a wound, subsequently dies. Besides, there may be cases in which the cause of death, in spite of the most careful consideration, is still obscure; or sometimes it may happen that the death of a person appears to be attributable as much to bodily disease as to an injury proved to have been received at the time when he was suffering from disease. How is an opinion to be expressed in such a case?

In *R. v. King* (C.C.C., 1953), the evidence showed that accused, a woman of 65 whose husband lay dying of cancer of the bowel, paid him a visit as he lay behind screens in the hospital ward. In the temporary absence of nurses, she took the pillow from under his head and held it over his face, lying on top of him: she was pulled from this position on the return of a nurse a few moments later, and the patient was found to be still alive. He died three days later and the evidence of the doctors in charge of the case—and of the pathologist making the autopsy—was to the effect that, though such an act might obviously be calculated to cause death, *there was no evidence that it had caused immediate harm or contributed to the cause of death.* A charge of attempted murder was found proven, but in view of the evidence the accused was conditionally discharged.

A charge of manslaughter brought at Lambeth Police Court in 1941 against a man of 72 was dismissed on the medical evidence. The circumstances were that during an argument with his son aged 46, blows were being exchanged when the younger man suddenly collapsed and died. Autopsy revealed a ruptured developmental cerebral aneurysm, and the medical evidence was that, though a blow to the jaw might have caused rupture, so equally might a rise in blood pressure which could be expected in a quarrel. On medical evidence being led to this effect, the charge of unlawful killing was not proceeded with.

The course which a medical witness ought to pursue, provided he has duly considered the circumstances before he appears in court, and his mind is equally balanced between the two possibilities, is at once to state his opinion without circumlocution, and not to allow equivocal views to be extracted from him in cross-examination. The sooner this position is made clear the better.

In all cases a complete autopsy must be made in order to ascertain the full facts and the precise cause of death.

A lecturer in chemistry at a London medical school fell in front of an electric underground train at Monument Station and was extricated dead. Not until autopsy was performed was it found that he had just swallowed a small package of sodium cyanide—and that he had for some time had tuberculosis of the lungs.

much inflamed and lined with a white powder, which was proved to be arsenic. It turned out that on the theft being detected the girl had taken arsenic for fear of her father's anger; she vomited during the flogging, and died in slight convulsions. Upon this Wildberg attributed death to the arsenic, and the father was discharged.

A bus driver, faced with suspicion of careless driving when he ran down a young man on an open road crossing a common near East Ham, was exonerated before the enquiry opened as a consequence of what was found at autopsy. In addition to injuries consistent with being run over by a heavy vehicle, the autopsy revealed seven superficial incised wounds of the left wrist such as are commonly found in suicide. Behind some bushes near the scene of the affair a bloodstained safety razor was found and it was later shown that the blood was of the same group as that of the dead man. Evidence was given that he had threatened to commit suicide, and the circumstances indicated that, having tried unsuccessfully to end his life by cutting his wrist, he flung himself under a bus.

Even when there may be no suspicion of poisoning, it is necessary to investigate the state of the stomach and its contents—whether it contains alcohol, the nature of the food, and the degree to which it has undergone digestion, for any of these matters may provide important evidence which may be incompatible with the evidence of the witnesses.

In *R. v. Spicer*, the falsehood of one part of the prisoner's defence was made evident by an examination of the deceased's stomach. The deceased was found dead at the foot of a stair. The prisoner stated that *after* he and his wife had had dinner he heard a fall. The woman had died instantaneously, and the fall was heard by neighbours at or near the dinner-hour. The stomach contained no trace of food. It was therefore clear that this part of the prisoner's story was untrue.

A wound may cause death either *directly* or *indirectly*. A wound operates as a *direct cause of death* when the wounded person dies either immediately or very soon after its infliction, and there is no other cause for death. In wounds which cause death *indirectly* the deceased survives for a certain period, and the wound is complicated by inflammation, embolism, pneumonia, tetanus, or some other mortal disease which is a consequence of the injury. Cases which prove fatal by reason of surgical operations rendered imperatively necessary for the treatment of injuries, presuming that these operations have been performed with ordinary skill and care, also fall into this category.

If a wounded person has been the subject of a miscarriage of treatment, and he subsequently dies, the question will arise as to what was the cause of death. A civil action might well be maintained, but no criminal charge would be likely to be proceeded with.

It would be no answer to a charge of death from violence to say *that there was disease in the body of the victim, unless the disease was the sole cause of death*. In many cases where death supervenes upon wounding, and it is admitted that violence has been inflicted, but asserted that it was not the cause of death, the medical evidence may be decisive.

A fracas developed in Poplar during "V-J" day celebrations in the second World War. Two men were fighting when one, according to an eye-witness "crumpled up and fell down in the gutter"; he lay still, and was found to be dead. The aggressor was arrested and charged with murder. Autopsy showed the cause of death to be advanced coronary occlusion by atheroma—which might be expected to cause collapse and death at any time, whether during a quarrel or not. Accused was allowed bail and later discharged at a summary hearing at a police court.

Cerebral or sub-arachnoid hæmorrhage, diseases of the heart and large blood vessels, asthma, phthisis, etc., provide similar exercises in common sense and reason. In some of these cases the person appeared to be in a good

state of health up to the time of the violence, and in others there was a slight indisposition. The history is nearly always much the same; it is only by careful medical examination and sound reasoning that the true nature of death is ascertained and justice is dispensed.

The wounded person may *by his own fault* cause an otherwise simple wound to become fatal. A man who has been severely wounded during a quarrel may obstinately refuse medical assistance, or he may insist upon acting in a manner contrary to the advice of his medical attendant; or by other imprudent practices he may prevent his recovery. In the case of the notorious Governor Wall, who was convicted of causing the death of a man by excessive punishment, it was attempted to be shown in evidence that the deceased had taken his own life by the immoderate drinking while under treatment in the hospital. In charging the jury, the Judge said that no man would be justified in placing another in so perilous a predicament as to make the preservation of his life depend merely on his own prudence. Neglect to call in a medical practitioner, or refusal to receive medical advice, will not always be considered as a mitigatory circumstance in favour of the accused, even though the wound were originally capable of being cured. *Refusal of medical advice or treatment* does not always operate as a mitigatory circumstance on the part of an assailant, because a wounded person is not compelled to call for medical assistance, or to submit to an operation. A medical witness may not be in a condition to swear that an operation would have saved the life of the victim; he may merely affirm that it might have afforded him a better prospect of recovery. Where a person has received a blow on the head, producing a depressed fracture, and symptoms of compression of the brain, a surgeon may propose an operation to elevate or to remove the depressed bone, but the friends of the patient may not permit the operation to be performed. In such a case the surgeon should state the facts to the court, and it is probable that in the event of conviction there would be some mitigation of punishment, because such an injury, if left to itself, would usually prove fatal, and no doubt could exist in the mind of any surgeon as to the necessity for the operation. But the negligence or improper conduct of a person who receives a wound thus rendered fatal, does not always exculpate the aggressor. Each case must be judged on its own merits.

Verdicts of manslaughter on the ground of negligence in cases where children have died without proper medical attention have been found against parents and guardians (*vide* "Neglect" and Children and Young Persons Acts, 1935 and 1938).

In some cases slight blows have been followed by fatal consequences even when no visible cause existed to account for the result. (*Vide* Vagal inhibition).

Possible causes of death which must now be considered in some detail are: –

1. Death from hæmorrhage.
2. Death from injury to vital organs.
3. Death from reflex (vagal) inhibition.
4. Death at a remote period —
   From enforced rest causing pneumonia, embolism, etc.
   From pathological changes *due to* the wound, toxæmia or infection.
   From pre-existent disease *accelerated by* injury.
   From independent disease *following* injury.

1. Death from Hæmorrhage. Loss of blood operates by lowering the blood pressure and producing fatal shock. A substantial quantity of blood escaping rapidly from a vessel may be sufficient to cause death by affecting the heart and circulation. It may also menace life by disturbing the functions of some vital organ or part into which it is effused. Thus a small quantity effused into or upon the substance of the brain, or at its base, may prove fatal by local disturbance; again, if, in a case of face or throat wounds, blood should flow into the windpipe, it may cause death by asphyxia.

A girl of 17 who was riding her pedal cycle along a suburban road was knocked off as a result of a passing milk van catching her handlebars. She was thrown to the ground, concussed and bleeding from the nose. The van driver and his mate placed her on her back in the van and drove her ¼ mile to hospital—where she was found to be dead. Her only injury was a broken nose but she had, whilst lying on her back, inhaled a quantity of blood with fatal results.

In wounds of the chest, involving the heart and lungs, death is frequently due not so much to the actual quantity of blood effused as to the mechanical changes which it produces in these organs. Several ounces effused into the pericardium may arrest the action of the heart whereas a similar loss into the abdomen would be negligible.

A young man who was endeavouring to remove a piece of furniture from his parents' home was obstructed by his father. Angry words followed, and, in an exchange of blows, the older man was punched in the throat; he broke off the fight, coughing to get his breath, and went indoors. Within ten minutes he was struggling to breathe, blue in the face and died before medical assistance could be obtained. Autopsy revealed a fracture of the right wing of the thyroid and an intra-laryngeal hæmatoma sufficiently large to obstruct breathing at the level of the vocal cords.

The absolute *quantity of blood* required to be lost in order to prove fatal varies according to various numerous circumstances. The young, the aged, and those who are labouring from some disease, may perish from loss of blood sooner than others who are healthy and vigorous. Infants are liable to die from this cause as a result of slight wounds. It seems likely that in the adult, a rapid loss of anything over 2 litres of blood (about one third of the total volume) constitutes an immediate danger to life. Fluid replacement of the blood volume is rapid, but protein replacement takes some days and the cell volume may not be restored for some weeks.[1]

Some persons are liable to excessive bleeding from slight injuries—a condition that is usually hereditary (hæmophilia). The slightest wound or puncture may be followed by intractable bleeding which may lead to death. When a person bleeds to death in what would, in common circumstances, be an unimportant wound, the admission of this fact may well lessen the responsibility of an accused person, though it cannot dispose of it.

A *sudden loss* of blood has a much more serious effect than the same quantity lost slowly.[2] A person may succumb to a quantity of blood lost in a few seconds which he would have been able to survive readily had it escaped slowly. This is one reason why the severance of an artery proves so much more rapidly fatal than that of a vein. Death speedily follows severance of a large artery like the carotid; but it takes place with equal certainty, although more slowly, from wounds of smaller arteries. Wounds of large veins, such as the jugular, may, from the quantity of blood suddenly lost, speedily end life. Such open veins are also liable to admit air into the circulation, causing death by air-embolism irrespective of the volume of blood lost.

Internal Hæmorrhage may equally prove fatal, for blood need not visibly escape from the body. In incised wounds the flow externally is commonly abundant, but in crushing, stabbed or perforating wounds the effusion may take place internally and rapidly cause death. In severe contusions or contused wounds involving highly vascular organs or tissues, the effusion may go on to a fatal extent, either into the cavities of the body or throughout the adjacent loose cellular tissue. In death from severe flogging blood may be effused in large quantity beneath the skin and among the muscles; this effusion will operate as fatally as if it had flowed from an open wound. A surprisingly large volume of blood may thus be effused. Most fatal internal hæmorrhages follow ruptures of the organs—injuries of the heart, lungs, liver, spleen, and kidneys in particular having thus caused death. These cases of ruptured internal organs and concealed hæmorrhages constitute a very difficult chapter of surgical diagnosis owing to the lapse of time before the volume of blood lost produces signs.

A man who had been run over was brought to hospital. He complained of pain in the back, but there were no symptoms of severe injury, and no marks of violence were seen on the skin of the back. He left the hospital and *walked with some assistance to his house.* A few hours afterwards he was found dead in bed. A large quantity of blood was found effused into the abdomen. A kidney had been ruptured transversely through its whole substance.

In these cases the hæmorrhage may have temporarily ceased, when slight muscular exertion may have caused it to recommence and to lead to death. A "lucid interval" of the same kind is seen in cases of head injury. (*vide* p. 265).

The means of ascertaining whether a person has died from bleeding by an open wound are these: Unless the wound is situated in a vascular part, we shall find the vessel or vessels, from which the blood has issued, divided, the vessels relatively empty, and the body more or less exsanguinated. Blood will commonly be found more or less clotted or dried on those surfaces on which it has fallen. If, with these signs, there is an absence of disease likely to prove rapidly fatal and no other probable cause of death is apparent, it may be fairly referred to loss of blood. This opinion may, however, be materially modified in reference to open wounds by the fact of the body not *being seen on the spot where the injury* was *actually inflicted, by the wound* having been sponged, the blood removed by washing, or blood-soaked dressings being destroyed. In these circumstances, the case must in a great measure be made out by presumptive proof; and here a medical witness may have to depend upon the duty of examining articles of dress, furniture or weapons, for marks or stains of blood, estimating indirectly the volume lost.

It must not be supposed that all the blood met with round a wounded dead body, or in a cavity of the body, was actually effused during life. As soon as the heart's action ceases the arteries cease to spurt, but so long as the blood remains liquid—and after it is again liquefied—it continues to drain from the divided vessels.

became fluid again some time after death, and *if Hume had merely been asked to dispose of parcels of the dismembered body such bloodstains might follow.* A jury disagreed on a charge of murder—and at a second trial Hume pleaded guilty to being an accessory after the fact.[1]

The quantity thus lost, however, is seldom considerable unless the veins implicated are large, or the body is dismembered. In wounds involving the great vessels of the neck the quantity of blood which drains from the wounded part after death may be large. The entry of air may limit the exit of blood (*vide* Air Embolism).

2. Death from Gross Mechanical Injury to a Vital Organ.

Many instances of this becoming a direct cause of death occur in the crushing of the heart, lungs or brain, as in falls and in street and railway accidents. Severe mechanical injury is sometimes accompanied by a considerable effusion of blood, so that the person really dies from hæmorrhage, but in other instances the quantity of blood lost is minimal, the extensive damage to the tissues being sufficient in itself to cause death by what is called "neurogenic" or primary shock.

Secondary shock may develop insidiously, some hours after an injury, resulting from loss of blood volume, fatigue, dehydration, pain, exposure to cold and wet, etc. A person may have received many injuries, as by blows or lashes, not one of which, taken alone, could in medical language be termed mortal; and yet he may die directly from the effects of the violence either on the spot or very soon afterwards. At the trial of *Governor Wall*, the judge directed the jury that the long continuance and severity of pain (in flogging) may be productive of as fatal consequences as if instruments or weapons of a destructive kind were used. It is rare indeed for a school beating to be a cause of death in Great Britain. One case, however, which excited public attention from the atrocity of the circumstances attending it, was the subject for a trial for manslaughter. (*R. v. Hopley*).

The evidence showed that the master had beaten a youth of 16 very severely for nearly two hours with a rope and a stick. The external wounds were slight, but autopsy showed that the muscles as well as all the soft parts beneath the skin had been considerably bruised and crushed, and that there were extensive effusions of blood in the connective tissue spaces of the arms and legs. There was no mortal wound in the common sense of the term, but there was no reasonable doubt that the boy had died from the sum of the violence inflicted on him by the master.

On a trial for murder, which took place in Germany, it was proved that the deceased had been attacked with sticks, and that afterwards he had been flogged on the back with willow switches. He died in about an hour. At autopsy there was no mortal wound, and no injury to a vital organ; there were merely the marks of abrasions and bruises on the skin, apparently not sufficient to account for death; but this was, nevertheless, very properly ascribed to the violence.

3. Death from Reflex (vagal) Inhibition.

Freeman[2] has reviewed the physiological mechanism of this form of sudden death from minor stimuli or injury of the wide net of "receptor" nerve endings forming the "afferent" pathway for reflex action by the inhibitory vagus nerve. Fatal inhibition of the cardiac and respiratory centres may occur after slight traumatic stimuli applied to certain parts; for example, a surgeon passing a catheter into the bladder or the abortionist an instrument into the uterus. It has also occurred from a slight blow on the throat or testicles and similar "receptive spots".[3]

[1] Camps, F. E., 1951. *Med. leg. J.*, 19, 2.
[2] Freeman, A. G., 1951. *Lancet*, I, 926.
[3] Simpson, K., 1953. *Modern Trends in Forensic Medicine*. London: Butterworth.

Cardiac inhibition may occur from pressure on the carotid sinus as in strangling. On the skin there may be some abrasion or slight discolouration, but these are neither constant nor necessary accompaniments of this event.

Concussion of the brain, unattended by visible mechanical injury, furnishes another example of sudden functional death.[1] A man receives a severe blow on the head; he falls dead on the spot, or becomes senseless and dies in a few hours. On an inspection there may be merely the mark of a slight bruise on the scalp. In the brain there may be no rupture of vessels or contusion of substance, and microscopy will not necessarily elucidate the issue.

Where boxing contests have ended fatally, we have experience of death occurring by three distinct methods: (1) by exhaustion, the combined effect of many blows, with intense effort and excitement in a person having some physical defect; (2) by gross injury—fractured skull, meningeal hæmorrhage, rupture of a viscus, etc.; (3) from "knock-out" blows on the point of the chin, or into the solar plexus. These produce temporary insensibility, and occasionally death, without any obvious mark of injury.[2]

In 1919 a well-known featherweight boxer, matched in London against a Frenchman, hit his opponent a blow to the point of the chin and two to the brow in the third round. None of these appeared to be particularly damaging, but the Frenchman went down on one knee, took a count of 5, was told to carry on but shook his head. He left the ring unaided but, shortly after, complained of headache, felt sick and became a little short of breath. He was sent to hospital, dying 31 hours later—of a subdural hæmorrhage on the left side.

In such circumstances, and, in estimating the culpability of the opponent, due regard must be paid to any unsuspected pathological condition found, such as degenerate vessels, kidney disease, thinness of skull, enlarged heart, etc. A referee will usually be present to give evidence that the blows exchanged were fair according to the rules of boxing.

In addition to shock from what may be called physical causes, there is beyond any question a mental form of shock, for it is familiar to every one. Fainting from fright or from some unpleasant sight or smell is too common to need mention; but such a "faint" may be a fatal one, and is a not very infrequent cause of sudden death in persons who, so far as careful *post-mortem* examination can show, are in perfect health, especially in the elderly.

Some of these cases must be ascribed to "vagal inhibition" of the heart, others to effects on the vasomotor centre.

From these considerations, it cannot be expected that in every case of death from violence or maltreatment there must be some visible *mortal injury*. When the circumstances accompanying death are unknown, a medical opinion should be expressed with caution; but if we are informed that the deceased was in ordinary health and vigour previous to the infliction of the violence, and there is no morbid cause to account for his *sudden* illness and death, there is no reason why we should hesitate in referring death to the functional effects of injuries.

In *R. v. Corio* (C.C.C., 1952), a youth was charged with the manslaughter of another boy of 20 whom he had struck with his fist in the doorway of a Hammersmith shop; his head had been thrown by this blow against a door knob. The injured boy did not lose consciousness: he went to a milk bar where he complained of "feeling rough", arrived home an hour after the assault and tumbled into bed still partly dressed. At 2 a.m. his brother noticed he was "snoring noisily"—an unusual event—and at 6 a.m. he was found dead in bed. A slightly depressed fracture of the skull on

[1] Denny-Brown, D., and Russell, W. R., 1941. *Brain*, 64, 93.
[2] Blonstein, J. L., and Clarke, E., 1954. *Brit. med. J.*, 2, 1523.

the left side above the ear had ruptured the middle meningeal artery and caused an extra-dural hæmorrhage.

Among non-medical persons a prejudice exists that no person can die from violence unless there be some *visible* mechanical injury to some organ or vessel important to life. This is an erroneous notion, since death may take place from the disturbance of the functions of an organ important to life without this being necessarily accompanied by a perceptible alteration of structure. *This is, after all, how life terminates in the aged: a functional lapse occurs.*

4. **Wounds indirectly Fatal.** Certain kinds of injuries are not immediately followed by serious consequences; but an injured person may die after a long or shorter period, and his death may be as much a consequence of the injury as if it had taken place on the spot. An aggressor is as responsible as if the deceased had been directly killed by his violence—*provided the fatal result can be traced to probable consequences of the injury.*

In *R. v. Elsie White* (Herts Assizes, 1947), a girl hurled an aspidistra in a pot (weighing 20 lbs.) down a narrow flight of stairs after her drunken father who had been abusing and striking his wife and, armed with a bread knife, was threatening further violence. It struck him on the head, felling him to the passage way below, unconscious. A few moments later he was sick and his family could not rouse him: he had died of inhalation of vomit. The skull was not fractured, and there was no visible contusion of the brain, but he had clearly been concussed by the head injury and a charge of murder followed, as it was argued that this was responsible for his inhaling vomit.

Death may follow a wound, and be a consequence of that wound, at almost any period after its infliction. It is necessary, however, in order to maintain a charge of homicide, that death should be strictly and clearly traceable to the injury. A doubt on this point must, of course, lead to an acquittal of the accused. In England a person can be convicted of murder or manslaughter if the deceased was in a bad state of health when attacked and the jury are satisfied that the injuries inflicted by the accused accelerated the death.[1] Death must,[2] for the purpose of a criminal charge, follow within

necessary, but *death from fright alone, caused by an illegal act, such as threats of violence, would be sufficient.* The abnormal state of the deceased's health did not affect the question whether the prisoner knew or did not know of it, if it were proved to the satisfaction of the jury that the death was accelerated by the prisoner's illegal act. The jury found the prisoner guilty, and he was sentenced to three months' imprisonment with hard labour.

Many cases might be quoted in illustration of the length of time which may elapse before death takes place from certain kinds of injuries, the injured person having ultimately fallen a victim to indirect consequences thereof. Wounds of the head and spine are particularly liable to cause death insidiously. The wounded person may appear to be going on well, when, without any obvious new cause, he has a relapse and expires. In general an examination of the body will suffice to lay bare the facts by which it can be argued whether death is to be attributed to the wound or not.

In one case the metal portion of a penholder was found embedded in an abscess in the brain of a deceased man. The foreign body had been there upwards of 25 years, as the result of an accident when the deceased was a boy at school. No symptoms had been exhibited at the time, and none was exhibited subsequently until a few months before death.

A man was shot in the left side of the chest, and the bullet remained lodged in the left lung for a period of 25 years. The bullet in penetrating had fractured the humerus at its neck, in consequence of which the upper extremity had been amputated at the shoulder-joint. The wound of the chest soon healed, but the patient remained during his life subject to fits of severe breathlessness and hæmoptysis, which eventually caused his death. On examination of the body the bullet was found lying behind the third intercostal space in the midst of the pulmonary tissue, but lodged in a cyst which communicated with the large air-tubes. An almost identical specimen lies in the Gordon Museum of Guy's Hospital: the man survived from 1916 to 1951, only then to die of the consequences of the bullet wound sustained.

In severe injuries affecting the spinal cord or column, death is not an immediate consequence, unless that part of the organ which is above the origin of the phrenic nerves (supplying the diaphragm) is wounded. Injuries affecting the lower portion of the spinal column do not commonly prove fatal for several months, death ensuing later from septic cystitis (often with calculous pyelitis), bedsores and toxæmia.

In discussing the deaths of persons who have recovered from the immediate effects (hæmorrhage, shock, gross injury), we may for the sake of clearness, classify them into:—

(*a*) Cases in which either operation or enforced rest proves fatal—from operative shock, pneumonia, thrombosis and embolism, etc.

(*b*) Cases in which the wound becomes complicated by a pathological lesion, which in turn proves fatal, e.g., fat embolism, infection, septicæmia, tetanus, etc.

(*c*) Cases in which a pathological condition was present before the injury, e.g., cysts or tumours, tuberculosis, etc., and where acceleration of the disease process might be argued.

(*d*) Cases in which a pathological condition of a totally different nature arose after the wounding, and the consequential sequence is doubtful, e.g., brain tumour after a head injury.

(*A*) *Consequence of Operation or Enforced Rest.* Both the necessity for operation (and anæsthesia) and for treatment in bed or enforced rest, as, for instance, in plaster of paris, carry their especial risks: death may ensue as a consequence of operation/anæsthetic risks (*vide* p. 71), and the question may arise to whether a person responsible for injury should still be held liable at law for death due to these less direct causes.

The law of England regards a surgical operation which has been made

necessary on account of an injury to be a consequence of that injury, and
the person responsible for the injury is held to be responsible also for all the
natural consequences of the injury, including any complications arising
from operation or anæsthesia. Even if the diagnosis were subsequently
proved erroneous, and certain treatment thus shown to be unnecessary,
the position is unaltered provided that it was undertaken *bona fide* and
that a reasonable degree of skill and care were exercised.

From decided cases it would appear that where death ensued upon a
surgical operation the law has regard to three circumstances: (1) the necessity
for the operation itself, (2) the competency of the surgeon, and (3) the fact
that the wound was dangerous and would be likely to prove mortal in any
event. A stupid error or grossly incompetent piece of surgery would un-
doubtedly qualify—even dispose of—culpability. Mere refusal to accept
the treatment considered necessary does not alter the situation.

In *R. v. Draper*, the accused so carelessly drove a waggon that he knocked down
the deceased, and a wheel passed over his left arm just above the elbow. The
deceased was taken to the Royal Free Hospital, when it was proposed at once to
amputate the arm, but he, after consulting with his friends, refused to submit to the
operation. The arm was then dressed and put into splints, and the man was told that
his life would be endangered if he did not permit his arm to be amputated. A week
later he consented to the operation. The arm was removed, but he died of pyæmia,
one of the secondary consequences of the operation. In the opinion of the medical
officers of the hospital, the man's life would have been saved if he had allowed
immediate amputation.

The judge directed the jury to put out of their minds the question whether death
had ensued from the refusal of the deceased to have his arm amputated, as that was a
matter of law, and that the question for them to consider was whether, owing to
the negligence of the accused, the deceased sustained the injury which led to his
death. The jury found the accused guilty.

Competence for forming a judgment, or for undertaking an operation,
means the possession of that average skill and experience which every legally
qualified medical practitioner is presumed by law to possess. This does not
preclude the possibility that error in diagnosis (and thus, perhaps, of treat-
ment) may occur. Everyone is liable to make mistakes, but it is important
that they shall be reasonable errors, made in spite of due care and skill.

Exceptional cases occur where death results directly from the medical
treatment; but these are reducible to two classes: (1) when the wound is
not in itself mortal, but the treatment causes death; and (2) when the *death
is clearly caused by the treatment*, either by reason of it being *unskilful* or not
being necessary to save life.

died from secondary hemorrhage not long after this further operation. The prosecution alleged that, notwithstanding the long period which had elapsed, the deceased had died from the unlawful act of the prisoner. The defence was that the deceased had died from an operation which was not necessary to the treatment.

In addressing the jury, the Judge said that if a man attacked another and certain results ensued, in the course of which the qualified and competent medical adviser called in took, in his discretion, a step the termination of which was unsuccessful, and which, perhaps, in the exercise of superior skill would not have been adopted, that termination would not save the man by whom the injury was inflicted from the consequences of his act. The jury had nothing to do with the question whether or not the offender contemplated the result of his act. The prisoner was, however, acquitted by the jury.

It remains that, in many cases, enforced rest results in complications like hypostatic pneumonia or phlebo-thrombosis—usually in the leg veins, and subsequent embolism.

An old lady of 80 was attacked with a shovel by her husband, sustaining four slicing tears of the scalp and slight surface contusion of the brain. The skull was not fractured. She was admitted to hospital where she died ten days later of a pulmonary embolism due to right femoral and tibial phlebo-thrombosis. The accused was too old and ill to stand trial. (*R.* v. *Bryant*, Stratford Police Court, 1948).

It is not necessary to show that the veins affected were injured, though this is often so: mere stasis from rest is sufficient for either complication. Time is an important factor to bear in mind in each case, for whereas pneumonia or embolism developing within a week or ten days of injury would seem to be acceptable as a complication of the event, the longer the lapse of time the more remote would appear the connection: so long, however, as there has been a continuous period of enforced rest the argument remains.

(*B*) *Complications of the Injury Itself* resolve themselves into three groups according to the time lapse:—

(*a*) Unexplained cyanosis and intractable circulatory distress, often with hyperpyrexia (and occasionally with skin petechiae) developing within a few hours, indicate the entry of fat globules into the blood stream from the site of local injury. Though most common after fractures of long bones, crushing of fatty tissues of any kind may cause fat embolism.

(*b*) Pinning and crushing injuries may be followed within a few days by necrosis of the injured muscle, as it was described by Bywaters in London air-raid victims.[1] A fatal suppression of renal function may ensue.

(*c*) Infection of the wound—either by fulminating clostridial or strepto-coccal bacterial invasion which rapidly extends into the blood stream to cause a septicæmia, or by a more insidious introduction of an organism requiring some days to develop, such as tetanus or anthrax.

The connection between trauma and disease in the latter cases are not so simple and it may be necessary for a doctor giving evidence to dilate to some extent on the mode of growth and spread of sporing organisms in order to establish the connection.

A man of 35 had an accident necessitating amputation of the right leg in May, 1935. The left ankle was crushed and lacerated at that time, and was dressed with lint and a white wool packing. On October 20 that year he had a subtaloid arthrodesis and a plaster of paris splint was applied. He was discharged on October 27. On November 1 he was admitted with classical tetanus which proved fatal three days later.

A spored tetanus organism was cultured at autopsy *from the subcutaneous tissue of the right knee stump* after sterilisation and opening of the unbroken skin. Cultures from the left foot gave varied growths of no significance.

[1] Bywaters, E. G. L., 1944, *J. Amer. med. Ass.*, 124, 1103.

A boy of nine was playing in a South London street when he received a punctured wound in the side of the neck from a piece of wood. The wound healed, but five days later he complained of a stiff neck and was taken to hospital. Two days later the classical features of tetanus developed and, though antiserum was given death occurred within 36 hours: serum treatment had plainly been given at too late a stage to be effective.

The source of a bacterial infection of a wound seldom requires proof, for the air, skin, street dirt, clothing, weapons and, of course, the air passages and bowel all contain micro-organisms of different kinds.   It is usually only in cases of tetanus and anthrax that proof of the source of infection become necessary owing to the possibility of civil proceedings.

(C) *Acceleration of Disease Present before the Injury.* It is by no means unusual for a person who has received a wound, or sustained some personal injury, to die from disease which was present before the injury; and whereas, in the minds of lay persons, death may naturally appear to be a direct result of the injury, the truth can be reached only by the most careful assessment after autopsy. A man may be injured while suffering from disease, or some morbid change tending to cause death may have become evident subsequently to the infliction of a wound, and death ensues. Without a careful autopsy it is impossible to refer death to the real cause, and the importance of an accurate discrimination in a case in which wounds or personal injuries have been caused by another must be obvious. A hasty opinion may involve the accused in a charge of manslaughter; and although it may be possible to show at the trial that death was probably attributable not to the wound, but to co-existing disease, one result of the evidence of a medical witness given before a coroner or magistrate may be that the person charged is imprisoned for some months before the trial.

A man may be severely handled, and yet death may take place from rupture of the heart, the bursting of an aneurysm, from cerebral hæmorrhage, or other morbid cause which it is here unnecessary to specify. If death can be clearly traced to any one of these diseases the aggressor cannot be convicted of homicide, for the medical witness may give his opinion that death might have taken place about the same time and in the same circumstances whether injury had been inflicted or not.

In *R. v. Giles* a man of 23 appeared at the Thames Police Court on a charge of murder. He had been involved in a scuffle in the street in which blows had been exchanged and in which his opponent had been struck in the face and chest, and possibly kicked before falling dead. Autopsy indicated that none of the injuries sustained, namely bruises of the face as from a fist, a glancing abrasion of the scrotum as from a boot, and bruises of the left shoulder, elbow and hip as from collapse and fall to the ground, could be held likely to affect consciousness or to have caused death. There was, however, advanced coronary occlusion by atheroma which was sufficient to have caused sudden death; death was no doubt due to this, though it was admitted that the reflex effect of a blow on the scrotum might possibly have added another factor. In view of the medical findings the prosecution offered no evidence and the accused was discharged.

coroner was informed; autopsy showed (a) fresh bruises of the left side of the jaw and the chin, together with a black eye; (b) the left shoulder was more heavily bruised and the second rib was fractured. It was clear she had been struck several times with a fist and thrown against her left shoulder. Frail as she was, likely to die (at 80), these injuries were felt to have accelerated her death. A manslaughter charge followed.

In *R. v. Wallis*, old-standing valvular disease of the heart was present in an elderly woman who had been severely maltreated, and the heart disease had caused severe symptoms long before the assault. For the defence it was urged that if in any case the cause of death be partly attributable to injuries and partly to natural and other causes, the accused is entitled to an acquittal. It was held that there could be no doubt that but for the injuries inflicted the woman would not have died; therefore the act of the accused was the immediate cause of her death.

In cases of a mixed nature probably the best test is to determine the extent to which the alleged violence, when not of a definitely mortal nature, might endanger life. In cases of this description the question is whether the violence, although not the immediate, was a significant accelerating cause of death.

In *R. v. Louisa J. Taylor* it was held by Lord Hale that the law applicable to these cases is as follows:—

"It is sufficient to prove that the death of a person was accelerated by the malicious act of the prisoner, although the former laboured under a mortal disease at the time of the act. In those cases in which a slight degree of violence had been followed by fatal consequences, it is for a jury to decide, under all the circumstances, upon the actual and specific intention of the prisoner at the time of the act which occasioned death. In most of these cases there is an absence of intention to destroy life, but the nature of the wound, as well as the means by which it was inflicted, will often suffice to show the intention of the prisoner. An accurate description of the injury, if slight, may afford strong evidence in favour of the accused, since the law does not so much regard the means used by him to perpetrate the violence *as the actual intention to kill*, or to do great bodily harm. Serious injury, causing death by secondary consequences, will admit of no exculpation when an assailant was aware, or ought to have been aware, of the condition of the person whom he struck. Thus if a person notoriously ill, or a woman while pregnant, be maltreated, and death ensue from a secondary cause, the assailant will be held responsible, because he ought to have known that violence of any kind to a person so situated must be attended with dangerous consequences. So if the person maltreated be an infant or a decrepit old man, or one labouring under a mortal disease, it is notorious that a comparatively slight degree of violence will destroy life in these cases, and the prisoner would properly be held responsible. A wound which *accelerates* death, *causes death, and may therefore render the aggressor responsible for murder or manslaughter, according to the circumstances*."

This dictum applies equally to general frailty or ill-health as to some local disease which might make the victim of an injury more vulnerable: the aged and infirm are subject to the same protection at law as those fit and able to defend themselves.

Those who have suffered malnutrition for long periods from gastric or intestinal complaints or by mere shortage of food, have undoubtedly a lowered resistance to trauma and infection[1] (see starvation). The chronic alcoholic suffers the same defect for much the same reason: nutritional defects are natural to alcoholism. (See alcoholic poisoning.)

In some persons the bones of the body are unusually fragile, so that they are fractured by the slightest force, and death may follow when no considerable violence has been used; but these being unexpected consequences, and depending on an abnormal condition of parts unknown to the assailant, his responsibility may not, *ceteris paribus*, be as great as in other circumstances. This condition of the bones can be determined only by X-ray or section at autopsy. Facts of this kind can show that the degree of culpability from

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[1] Simpson, K., 1953, *Modern Trends in Forensic Medicine*. London: Butterworth.

violence used in an assault cannot always be measured by the effects: a careful assessment of the general conditions and proper attention to the significance of local disease are essential to a fair judgment.

(D) *A specific disease apparently unconnected with the wound arises subsequently.*

Cases of this kind are likely to cause great difficulty in interpretation, though certain delayed consequences of injury are common enough to demand acceptance. For example, after violence to the head with or without obvious physical damage, meningitis may supervene. This may not become clinically obvious for many weeks, even months, or it may be retarded for an indefinite period. Similarly, a schoolboy may have his ears boxed by a master and may subsequently complain of pain in the head and may die within a week or two. At the autopsy meningitis may be found and the question arises whether it *is due to the blow or not. If the meningitis is due to the ordinary septic organisms, an effort should be made to ascertain where the septic process began, for it is possible that a quiescent middle ear or antrum infection may have* been lit up by the violence.

An Army despatch driver aged 37 sustained a fractured skull in a vehicular accident in 1939. He was treated at the Army Head Injury Unit at Oxford for several months, but, on discharge, was still deaf in the left ear and suffered occasional otorrhœa. The left side of the face was weak. On December 24, 1951—12 years after his injury—he was found unconscious in bed: the C.S.F. was purulent (23,000 W.B.C. with 95 per cent polymorphonuclear cells). Gram positive cocci were present in large numbers and non-hæmolytic streptococci were cultured. He died two days later. Autopsy revealed left otitis media, osteo myelitis of the mastoid bone and an abscess in the temporo-sphenoidal which had ruptured on the surface of the brain.

Even if tuberculous meningitis is found, it is still possible that the injury may have initiated the disease, although in such cases it is highly probable that another focus of tuberculosis will be found in the body. An injury to any part of the body may lead to a lowered resistance at that part and this may predispose to the lodgment of bacteria at that site and the subsequent onset of disease. The fact that no evidence of injury may be found at the alleged site leads naturally to differences of opinion about the relationship of the trauma to the subsequent disease. In such cases the injury must be proved and if the symptoms of disease appear in a reasonable time in a previously healthy person there is a presumption that the injury may have been the casual factor

When a pathological condition such as tuberculosis or a tumour such as a glioma appears some time after an injury it is quite natural for a lay person to assume that the two events are closely related. This assumption is not warranted when the relationship is merely of time, even when the development of a disease follows closely upon injury. Both disease processes and new growths develop naturally in the vast majority of cases and, although injury may be a precipitating agent, it must rest with the medical examiner to define as far as he can whether any causal relationship exists. The principal points on which one would base such opinion would be:—

(a) the clear understanding that a relationship in time does not in itself form a necessary indication of any other form of relationship;

(b) that persons who are the subject of disease or new growth readily attribute the beginning of that disorder to an antecedent injury if a direct question to that effect is asked. This must be constantly borne in mind when the history and symptomatology of a case is being examined;

(c) functional disorders are quite common after both disabling injuries and minor trauma. These functional disorders should not be assumed to be examples of malingering, for they may be very real to the sufferer though no physical basis for the symptoms can be found;

(d) special conditions must be satisfied in order to establish a possible relationship between trauma and disease:

> (i) that where injury has broken down barriers of defence or admitted infection, or the process of repair is complicated by disordered proliferation of tissues, the ordinary consequences of these events might reasonably be said "to follow upon and be due to the injury".
>
> (ii) if trauma can initiate a disturbance of the tissues requiring repair—as in a bruise, a tear of ligaments or a fracture of bone— it needs only some disorder of that repair process to cause the development of "a tumour".

Although it might be thought reasonable to set some limit of time to permit the continued application of these principles, no arbitrary limits should be attempted. Some processes of disordered growth—certain tumour growths in particular—are remarkably slow in their development.

The subject is a vast one, and not within the scope of this work. Stern set out in 1945 a comprehensive survey of the evidence for, and against, trauma being associated with new diseases arising subsequently, and those who desire to explore the matter further should consult his work.[1]

Acceleration of Pre-existing Disease (which may have been unsuspected) constitutes another problem altogether. A disease process such as tuberculosis of the lungs or a quiescent septic infection may be disturbed by injury and thereby enabled to spread. Even where the original infection is comparatively slight, the breaking down of tissues by a blow may result in the free access of organisms to the damaged part and cause a sudden exacerbation of symptoms. A kick from a horse in the region of a vascular renal tumour may easily cause it to break down its natural barriers and - for the first time—to bleed or to detach growth cells into the renal veins with fatal results.

When injury to a part is followed shortly after by symptoms referable to that part and the development of a chain of events which might be related to disturbance of pre-existing disease, it is reasonable to ascribe the process of reactivation and spread to trauma.

A child of eight, attending school as a normal child, fell to the ground whilst playing one February 27th. It appeared to have been concussed, remaining semiconscious for about an hour and sleeping for the rest of the day. On the next day there was a squint, the speech was slurred and the child could not keep its balance whilst standing. A neurologist made a clinical diagnosis of a brain stem tumour, probably developmental—and vascular enough to have had its substance disturbed by the trauma of fall to the ground. Deep X-ray therapy effected some temporary improvement, but towards the end of November the condition deteriorated and a respiratory infection ultimately developed in the first week of December of the same year. The view was expressed that *the tumour was a malignant developmental growth*, and that the clinical course of events and autopsy findings afforded *'no basis for a suggestion that injury was to be associated with the development of a tumour*, but that it would have been possible for injury to the head to have caused bleeding into its substance and to have precipitated a period of unconsciousness and symptoms or signs drawing attention to its presence. It was most unlikely that the course of the disease (over some ten months) could have been influenced to any significant degree by the incident in the playground'.

[1] Stern, H.A. 1945. *Trauma in Internal Disease.* London. William Heinemann.

Where the condition is one that does not lend itself readily to association with trauma on the lines set out above, as for instance with kidney lesions following limb crushing, proof of association may require some special reference to work like that of Bywaters[1] in order to substantiate a relationship.

WHEN WAS THIS INJURY INFLICTED?[2]

This question may arise in casual deaths from falls, in abortion by instrument, in rape, and when the accused asserts that a wound, either on himself or his victim, was caused in an innocent way on a date that does not agree with the theory of the prosecution as to how or when it arose. It cannot be answered with any exactness, but a medical witness may be asked to say whether the state of the wound is consistent with the stated facts as to time, making allowance for the exceptions with which experience has made him familiar. It must be remembered that some injuries, like those to the hymen, never heal, merely becoming covered by a new surface.

Normal repair. When a part of the body is injured, certain chemical and physical changes occur as a result of which capillary dilation and œdema develop almost at once. This is followed by the migration of white cells from the capillaries into the damaged area, and if the part be examined by the "window-method"[3] the white cells may be seen clinging to the wall of the vessels prior to migration within a few minutes. They then migrate in increasing numbers, a phenomenon which can be seen quite well microscopically within 30 minutes[4] but which no doubt is a continuing process from the moment of wounding. The amount of exudation and infiltration depends on the extent of tissue damage. In the early stages the white cells of the extravasated blood must be distinguished from migratory cells. These polymorphonuclear leucocytes begin to fragment in three to five hours, a process of degeneration which is usually complete within 24 hours[5] and which liberates a digestive proteolytic enzyme.

In a clean wound the process of repair is seen in a few hours when the fibroblasts begin to proliferate and budding of loops from the capillaries with the formation of granulation tissue occurs. If the edges of the wounds are in apposition they become glued together by fibrin and healing occurs without the formation of granulation tissue.

Other Factors. So many factors are concerned in the causing and healing of wounds that exact determination of the age of a wound is impossible; but it may be said that small clean wounds will scab over in from 10 to 24 hours; signs of inflammation (in such as are infected) will be apparent in from 20 to 40 hours after infliction, and towards the later limits pus will be evident; granulation tissue of appreciable extent will rarely be seen within a week. When once suppuration has been established in a wound, the wound may keep on suppurating for an indefinite time without much sign of healing; in such a case, therefore, the limits will have to be so wide that they may be useless for medico-legal purposes. If parts of it show signs of scarring, a narrower limit may be fixed. It must not be forgotten that in cases of lowered vitality, in certain endocrine disturbances and in deficiency diseases, healing of wounds may be greatly delayed. Injuries from burns and corrosives heal very indolently.

[1] Bywaters, E. G. L., 1944, *J. Amer. med. Ass.*, 124, 1103.
[2] I *de also* p. 104, where the age of a scar is considered.
[3] Clark, E. R., and Clark, E. L., 1939, *Amer. J. Anat*, 64, 251.
[4] Carscaddon, W. J., 1927, *Arch. Path. lab. Med.*, 4, 329.
[5] Higgins, G. M. & Palmer, B. M., 1929, *Arch. Path.*, 7, 63.

In bodies long dead, there may be some difficulty in distinguishing the effects of gangrene in a wound from those of putrefaction. Gangrene implies the death of a part in the living body, and putrefactive changes take place in the dead part, as in the entire dead body. If changes resembling those of gangrene are found in a wounded limb, while the rest of the body is not in a putrescent state, there may be some reason for the opinion that there was gangrene during life. In such a case, however, due allowance should be made for the more rapid decomposition of wounded parts. If putrefaction is advanced, the opinion of a person who has not seen the deceased while living can be little more than a conjecture.

The age of a **bruise** must be given also with some caution. The changes which take place in the colour of a bruised spot will serve to aid the witness in giving an opinion on the probable time at which a contusion has been inflicted. After a certain period, commonly in 18 or 24 hours, the blue or livid margin of the spot is observed to become lighter; it acquires a violet tint, and before its final disappearance it passes successively through shades of a green, yellow, and lemon colour. During this time the spot is increased in extent, but the central portion of the bruise which received the violence is always darker than the circumference. These features are due to changes in, and the absorption of, the blood pigment. The colour is finally removed by the absorption of the effused blood. The extent and situation of the bruise, the degree of violence by which it has been produced, as well as the age and state of health of the persons, are so many circumstances which may influence the progress of these changes. Thus a bruise takes very much longer to disappear in old persons than in the young. One frequently finds effused blood in a bruise in an old person four or five weeks after the infliction of the injury. Where the membrane beneath which the blood is effused is dense, the bruise, *cæteris paribus*, is not so rapidly apparent to the eye, as the blood has to travel farther to reach the skin surface; nor, when formed, do the above changes take place in it so speedily as when the blood is effused into a loose subcutaneous tissue like that surrounding the eye or existing in the scrotum. In some instances a bruise has been observed to disappear without undergoing changes of colour at its margin. On examining a bruised portion of skin which has suffered from a severe contusion, we find that the discolouration affects more or less the whole substance of the true skin, as well as the tissues beneath it.

These remarks in general hold good for superficial bruises where there is no great quantity of blood poured out; if, on the other hand, there has been a copious outflow of blood which has been able to coagulate into a clot of some size, absorption of the clot with a *restitutio ad integrum* of the affected tissues is a process of very uncertain duration.

An autopsy was performed on a man somewhat advanced in years, who four weeks previously had broken a bone in his leg; the ends of the broken bone were quite smoothed off by absorption, but round them was a large, still apparently quite recent, clot of blood. It was impossible to state the date of the fracture, even approximately, from the condition of the blood clot; the smoothness of the broken ends of the bone strongly suggested a probable duration of at least two or three weeks, but there was no callus.

Traumatic effusions into the subdural space are notoriously slow to repair — indeed most become encysted and remain so for life, gradually losing pigment. (See Head Injuries, p. 301).

Intact red cells have been found in bruises after several weeks, but it is

obviously impossible to tell whether such cells are the product of the original injury or whether they are due to a subsequent secondary hæmorrhage. Hæmosiderin may be found in and about a bruise and in the adjacent lymph glands soon after its infliction and its presence gives us little definite information about its age. It is probably safe to say that it is not usual to find this iron containing pigment in less than 12 to 24 hours. Hæmatoidin, an iron free compound derived from blood, may seen be in the form of needle-like crystals in old bruises. It is unlikely to be found in less than a week.[1]

In fractures of bones it is usual to find the firm clots of blood surrounding the broken ends of the bones showing signs of organization in about 48 hours, *the formation of osteoid matrix in about three days, and its transformation* into callus starting about the end of the first week. Callus formation is well advanced in 10 or 12 days. Callus is the cementing material thrown out between the ends of a broken bone, which gradually changes into bone; if then callus is felt the fracture is probably of this duration at least, but if *none* is found it is impossible to state *in the living* what is the age of a fracture. If callus is present, we may form some idea of the age of a fracture by the hardness and firmness of this substance; six weeks to two months is the average period for it to undergo a complete conversion into material *as hard as bone*. Callus may remain for long periods in certain cases, and this may cause difficulty in estimating the age of a fracture. Once a fracture has acquired genuine bony union, there is little chance of ascertaining its age. In all cases, however, an X-ray examination of the bone, and where possible a microscopic examination of sections of the tissues should be made.

In dislocations the only chance of estimating their age is the possible presence of a bruise, the colour of which may give some indication. This is a comparatively slight chance, and if the blood has escaped very deeply amongst the tissues it may not come to the surface for a long time, and give therefore a false estimate of the date of the injury. In older cases the amount of new fibrous tissue or the formation of a false joint may give some indication of the age of the injury, as for instance with old fracture dislocations of the femur up onto the wing of the pelvis.

WITH WHAT WEAPON, OR HOW, WAS THE INJURY INFLICTED?
Evidence from the Wound itself

It is not necessary to prove that a weapon has been used for the production of a wound, for the words of the statute are: "Whosoever shall, *by any means whatsoever*, wound or cause *any grievous bodily harm* to a person", etc.; yet evidence of the use of a particular weapon in case of assault may be an important part of the evidence and may also materially affect the amount of punishment awarded on conviction. When, upon the clearest evidence, it is certain that a weapon has been used, it is not unusual for the accused to allege that no weapon was employed, but that the wound had been occasioned by an accident. A medical witness is seldom in a position to swear that a particular weapon produced at a trial must have been used; all he can state is that the wound was caused either by it or by one similar to it.

In *R.* v. *Heath*[2] (C.C.C., 1946) the marks left on the skin of the victim by a switch with a diamond patterned leather woven covering were so clearly defined that they could be measured with mathematical precision and compared in fine detail with the weapon found in Heath's attache case.

[1] Muir, R. & Niven, J., 1935, *J. Path. Bact.*, 41, 183.
[2] Simpson, Keith, 1947. *Police J.*, 20, 266.

Great care must nevertheless be exercised by the doctor in associating particular wounds with particular weapons.

A man was stabbed in the face, and a knife *with the entire blade* was produced as circumstantial evidence against his assailant, the surgeon having stated that the wound had been caused by that particular knife. The wounded man recovered; but a year afterwards an abscess formed in his face, and the broken point of the weapon used by the assailant was discharged from it. The wound could not therefore have been caused by the knife which was produced as evidence against the accused at the trial.

Although the criminality of an act is not lessened or impugned by an occurrence of this kind, it is advisable that such mistakes should be avoided by the use of proper caution on the part of the medical witness.

When a weapon is produced there is no difficulty in answering the question: "Could this weapon have inflicted this wound?" but the difficulties immediately begin when no weapon is forthcoming, and the witness's opinion is founded on an examination of the wound only.

There are one or two fundamental properties of the skin which have a very important bearing upon this subject.

The skin is elastic, and is, in a living healthy state, **slightly on the stretch** in all directions parallel to its surface. It therefore follows that in punctures with a *blunt* instrument the hole must be as a rule a little smaller than the diameter of the weapon, for the skin yields by stretching without tearing round the actual breach of continuity. (An experiment with a lead pencil on a piece of sheet india-rubber will well illustrate the point.) If the weapon is sharp at its point, but blunt elsewhere, the inequality between the orifice and the weapon may be even greater. Similarly in incised wounds the tension will draw the edges apart, so that the aperture becomes much wider than the width of the cutting blade. A stab with a double-edged weapon may show a complete diamond-shaped aperture, while one with a single edge and blunt back may show a half-diamond shape, as below, but unless the blunt edge is very broad it is unlikely to leave more than an elliptical split with one extremity torn.

The skin is variably movable on the underlying tissues; **it is flexible, fairly tough, and somewhat sticky.** It follows then that when an edged weapon is drawn across the skin we may get several cuts from one action, separated from one another by small bridges of uncut skin where it folded on itself.

Even with a sharp knife the skin may be thus dragged, for, however sharp it is, it always has some projecting points which may catch, and with jagged and blunt knives this is true to a still greater degree. The stickiness of the skin and the jaggedness of the weapon explain the inversion and eversion of the edges of a stab wound, showing the direction of the last force used.

We must now consider in some detail the various forms of wounds, applying the above principles.

1. Abrasions. When an object presses into the skin it makes an impression on it. If the contact made is more forceful the cuticle becomes crushed at the point of impact, often bearing a pattern of the instrument. When contact is of a brushing or grazing kind the clarity of any surface pattern is obscured, but the direction in which the cutis is torn may give an indication of the direction in which the blow was delivered—or the body slid.

Most abrasions become better defined as the injured cuticle dries, for it becomes brown and the contrast between it and the uninjured skin increases markedly.

2. **Incised Wounds.** The sharpness of the instrument is to some extent directly related to the cleanness and regularity of the edges; shattering, flying glass may cause remarkably sharp edged cuts, though when shattered on impact local surface abrasions may also be present. The amount of blood effused may also give help in assessing sharpness, for it is well recognized that a vessel cut cleanly is more apt to bleed freely than one which has been torn across. Cases are known in which a limb has actually been avulsed with scarcely any bleeding, and torsion of a vessel is a well-recognized method of checking hæmorrhage from it. It must be admitted, *per contra*, that an artery half severed bleeds *more freely* than one completely cut across, for it can neither retract nor contract.

The length of an incised wound gives no indication of the length of the cutting edge, for the point of a knife may be drawn any distance down or across limb or trunk.

3. **Punctured and Stabbed Wounds.** By a punctured or stabbed wound is understood a wound produced by a pointed instrument being driven in through the skin, as opposed to a cutting edge being drawn across the skin. The size of the entry is slightly smaller than that of the instrument unless rocking enlarges the opening.

The depth of the stab is one of the most important points to note, for it will often give a clue to the length of the instrument used, though it must be remembered that if driven in with much violence the yielding of the tissues may allow of a penetration deeper than the length of the weapon. This is especially true of stab wounds of the abdomen.

The careful examination of a wound once disproved a charge of malicious stabbing brought against innocent persons.

The body should be seen soon after the infliction of a wound and before there has been any interference with it: surgical repair or further surgical stab wounds for drainage may easily cause error.

4. **Lacerated Wounds** do not in general present greater difficulty with regard to their origin than those which are incised or punctured. The means which produced the laceration are commonly indicated by the appearance of the wound. These injuries are generally the result of blows from semi-sharp instruments like choppers or iron bars capable of splitting the skin, especially where (as over the scalp) it is pinned and split against bone.

They are common in street vehicle accidents, from either impact or fall. They are, however, frequently met with on the bodies of new-born children whose tender skin is easily split by direct impacts.

Glass, earthenware, sharp flints, usually produce lacerated wounds with jagged uneven edges; but, on the other hand, it must be remembered that the actual edge of a piece of broken glass is probably sharper than the sharpest of knives. It is therefore exceedingly difficult, if not impossible, to distinguish, by the mere cleanness of the edge of an individual cut, between a cut thus produced and one produced by a knife. It is the **little marginal cuts and abrasions** produced by fragments of the glass or pottery that will chiefly throw light on the nature of the wounding object; fragments of glass or stone are commonly found in the wound.

A case occurred in which a deeply penetrating wound on the genital organs of a woman, which had evidently caused her death, was attributed by the prisoners charged with the murder to her having fallen on some broken glass; but it was proved that the edges of the wound were bounded everywhere by clean incisions, which rendered this defence improbable, if not impossible. A similar defence has been made on other occasions. In one, a man struck the prosecutor, and knocked him against a window. On examination there were three deep cuts on the face of the prosecutor, but no weapon had been seen in the hands of the prisoner. He was charged with cutting and stabbing. The surgeon stated that the wounds appeared to have been inflicted with a knife or razor-blade, and not with broken glass. But if the wounds had been made with glass, particles of that substance would probably have been found in them and there were none. The prisoner was acquitted, the infliction of the wounds by a weapon not being considered to have been sufficiently made out.

In *R. v. Ankers*, a clean cut as from a penknife, about two inches long and one inch deep, was found on the person of the prosecutor, who had fallen during a quarrel with the prisoner. Some broken crockery was lying near the spot, and it was alleged for the defence that a fall upon this had caused the wound. This allegation was inconsistent with the clean and even appearance of the edges of the wound. The prisoner, in whose possession a penknife had been found, was convicted.

A careful examination made when a wounded person is first seen enables a medical witness to meet suggestions of this kind.

appearances may not be explained on the supposition of a fall. A medical witness is rarely in a position to swear with certainty that a contused wound of the head must have been produced by a weapon, and *not* by a fall. Some circumstances, however, may occasionally enable him to form an opinion on this point. If the marks of violence are on the summit of the head, it is highly probable that they have been caused by a weapon, since, this is not commonly a part which can receive injury from a fall. If, however, sand, gravel, grass or other substances be found in a contused wound, this will render it highly probable that the injury was really caused by a fall. When the question is simply whether a contused wound was produced by a blow of the fist or by a weapon, it may admit of an answer from an examination of the wound, as in the following cases:

In *R. v. Howes*, the deceased, the wife of the prisoner, was found with severe contusions on the head and face and a lacerated wound on the temple. She died from extravasation of blood on the brain. The defence was that deceased had fallen against a fender while intoxicated and so had caused the wounds; but it was properly stated by a medical witness that, although a lacerated wound on the side of the head might have been so caused, the other injuries bore the characters of repeated blows. Counsel for the defence wished to make a general amalgamation of all this violence, although the witness had stated that the head, from the temple to the occiput, was "one mass" of contusions, independently of the bruises found on the face. Apart from all scientific speculations, no fall upon a fender could possibly account for the *whole* of these injuries. The prisoner was convicted of manslaughter.

In *R. v. Budd*, where a man was charged with killing his wife by blows, it appeared that he had either kicked her, and produced the injury which caused her death, or that she had fallen upon some wood as a result of this violence. It was held that it was not material whether death was caused directly by the blow or kick, *or whether* the prisoner struck or pushed his wife, and she fell so as to produce the injury which caused her death; the prisoner would equally be guilty of manslaughter. If it could be shown that the fall was the result of some accident, then it might be a good ground for defence. He was convicted.

The chief difficulty in regard to contused wounds arises (as has been indicated above) when the wound in the skin lies over a bone separated from it by a comparatively thin layer of soft tissue, the typical places being the scalp, cheek-bones, the jaws and the back of the fingers. In these situations, wounds produced by blunt objects, such as a wooden crate, iron bar, jemmy, hammer, stone in a stocking, etc., are commonly apparently clean-cut *skin wounds, and only a close scrutiny of the edges and the surrounding tissue will* reveal the fact of a crushed or bruised condition being present. Usually examination by a hand lens will enable the observer *to see the torn extremities,* the rough margins, exposed hair bulbs and torn fibres and vessels in wounds from blunt instruments. If some time has elapsed before a wound is examined, great caution will be required in forming a judgment.

A man, it was alleged, had been stabbed *on the head with a knife. The prisoner* struck the blow, and he certainly had a knife in his hand at the time, but whether the wound was or was not produced by some part of the knife could not be determined from the evidence of eye-witnesses. In defence it was urged that the prisoner had inflicted the wound with his knuckles, and not with a knife. When a surgeon was called to examine the wound some time after its infliction, there was so much contusion and laceration about its edges that it was impossible to ascertain with the necessary precision, by what means it had been caused. There was suspicion, but no medical proof, that a weapon had been employed.

Doctors and pathologists should be cautious in accepting the statements of others that a weapon has been used *unless the wound itself bears such*

features as to render the fact reasonable. During a scuffle the person assaulted may be easily deceived as to the way in which an accused party inflicted a wound upon him; and a motive may sometimes exist for imputing to an assailant the use of a weapon during a quarrel. In such cases a medical witness should always rely more on the appearance of the wound for proof of the use of a weapon than on any account given by interested parties.

There is no doubt that some means of discrimination between the effects of falls and blows affecting the same part of the body would greatly aid the administration of justice; but as no two cases coming under this class of injuries are precisely alike, either in the part wounded or the amount of force employed, it is scarcely possibly to introduce general rules. It is commonly believed that a mere fall is not sufficient to produce the same degree of injury that may be caused by a blunt weapon applied suddenly to the head by human force; but a severe fracture may arise from a simple accident of this kind, and present nearly all the features of homicidal violence. The difficulties at criminal trials will be found to proceed, not so much from want of rules to assign the violence to one condition or the other as from a want of proper observation when the wounds are first examined. If minute attention were given to an examination of these injuries soon after their occurrence, details might be noticed which would help the medical witness to a more certain conclusion.

The case of Mr. Briggs, who was murderously assaulted in a railway carriage, furnishes an illustration of the ease with which homicidal and accidental violence may be distinguished provided attention is directed to this question at the time. There were several wounds on the head which could not have resulted from one cause. It appeared probable that some had been inflicted on the deceased by an instrument while he was in the carriage; that he had been thrown from it while the carriage was in rapid motion, and the fall had produced other bruises. The doctor who examined the deceased found a transverse jagged wound across the left ear, and above this there was a scalp swelling as well as two wounds, with effusion of blood beneath, and corresponding fractures in the skull. There had obviously been more than one distinct application of force to produce such injuries. The fractures in the skull in two distinct places indicated the use of a heavy blunt weapon, while the scalp swelling was probably caused by the head coming in contact with the ground at that point.

A B.O.A.C. Officer was found dead on the Southern Railway track at Bermondsey at 10.15 p.m. one February—i.e. in pitch dark—following reports that a crash had been heard. A train at London Bridge was found to have a broken window, and two dentures soiled with blood lay on the carriage floor. Inspection along the line showed an iron stanchion with hair similar to deceased's crushed into the paint, and there seemed little doubt that the man must have been leaning backwards out of the window, as is common in 'Peeping-Tom' episodes, and as a consequence sustained a sweeping impact which threw the head back towards the train, dislodging the dentures and breaking the window. The greater part of the left side and back of the head had been violently crushed and torn away, and there were further bruises running along a line across the back between the hips, where the man lay back across the door window. He had left home saying he was going to church and then to visit friends, neither of which he did; there was no question of suicide.

When it is a question which of two weapons produced certain wounds found on the head, the difficulties of medical evidence are increased.

In *R.* v. *Whiteway* (C.C.C., 1953)—the Tow-Path Murders, two girls bore wounds of the head and trunk which, it seemed likely, were inflicted with the same weapon.[1]

In most instances an accurate observation of the form of a contused wound, and an early comparison of it with the alleged weapon or the sub-

stance said to have produced it, will enable a witness to come to a correct conclusion on the subject. The situation and character of the wound may be such that *no accidental fall could reasonably account for its production.*

In *R. v. Skelton* the deceased, an old man, died from violence to the head. He was found in the road insensible and bleeding, not far from the prisoner's house. An angular stone was lying near his head. There were no bruises on the body, but on the left side of the crown of the head there was a square-shaped hole about the size of a half-crown, the bone being there driven in. *Three inches below this,* at about the tip of the ear, there was another fracture of the skull under a narrow scalp wound about an inch in length. In the prisoner's house was found a hammer, which had a square face, with the corners rounded off, and on comparing *this with* the indented wound and fracture it corresponded very closely in shape and width. The other end, when compared with the smaller wound near the ear, also corresponded. The hammer, as it frequently happens with heavy bruising instruments, had no blood upon it, nor anything to indicate that it had been used for inflicting the injuries. The stone found near the deceased had upon it blood and mud at one corner, and a white human hair adhered to it. It was admitted by the medical witnesses that, if the deceased had fallen heavily upon this stone, it would have accounted for the smaller wound; but, in regard to the indented wound, it was suggested that, if the victim had been knocked down by a horse and trampled on, the "caulker," or square piece of iron at the heel of a horseshoe, might have produced it. If that were true it was evident that the other part of the shoe *would have left some mark, of which there was no trace.* The hat worn by the deceased at the time presented no indentation or mark. It seemed probable that the injury was produced by a weapon, but the evidence failed to connect the prisoner with the act.

6. Bruises without Skin Incision.

Comment on the nature of a bruise or effusion of blood may be offered on the following grounds:

    (a) When death follows quite soon after injury, the shape of a bruise corresponds fairly closely with the shape of the bruising agent or weapon.

    (b) More frequently the bruise has no close relation either to the shape of the object producing it or the amount of violence employed, having had time to spread.

    (c) There may be a deep effusion of blood without any visible external bruise whatever; its real nature may therefore be quite obscure.

(a) Bruise corresponding to Shape of Object. In beating, the impressions caused by the weapon on the skin are sometimes ecchymosed, and indicate its nature with precision; so also in strangulation, when the fingers have been violently applied to the softer part of the neck, the indentations produced may serve to indicate the manner in which the grasp was effected. The form of an ecchymosis may occasionally furnish presumptive evidence against an accused party.

In *R. v. Heath* (C.C.C., 1946) and also in *R. v. Gorringe* (Maidstone Assizes, 1948) there were marks of biting on the skin of the breast. In the latter case they were particularly well defined by surface abrasions of the cuticle, and direct comparison was made between a 'bite-impression' of a cast of accused's opposing front teeth and the skin injuries. They were identified in numerous details.[1]

In an attempt at murder mentioned by Stackie, the prosecutor, in his own defence, struck the assailant violently in the face with the key of the house-door, this being the only weapon he had near at hand. The ecchymosis which followed this contusion corresponded in shape with the wards of the key; and it was chiefly through this very singular and unexpected source of evidence that the assailant was afterwards identified and brought to trial.

Similarly in cases of alleged rape with struggling on the part of the victim small bruises corresponding to finger-marks may be found about the arms and legs. Cases of instrumental abortion may show similar marks.

[1] Simpson, Keith, 1951. *Internat. Crim. Police Rev.*, 6, 232.

(b) *Bruises not corresponding to the Violence.* Such want of correspondence is without doubt the commonest event, correspondence being unusual. The principal reason for this is that bruises are escapes of blood into tissues through which they continue to spread and enlarge, but there are also certain confusing conditions which demand attention:—

(i) Hæmorrhages, small or large, beneath the skin are very common as a result of disease without any known violence having been inflicted. In aged persons it is not unusual to find the legs and feet covered with livid patches. These discolourations, which after death or during life might be mistaken for ecchymosis from violence, arise from circulatory stasis and anoxia. The marks are commonly observed on the lower limbs because they are far removed from the centre of circulation, and stasis is more marked.

Purpura, scurvy, hæmophilia, drug rashes and "malignant" cases of infectious disease are all illustrations of diseases in which spontaneous subcutaneous bleeding may take place. In general there is no difficulty in distinguishing such cases, at least during life. The multiplicity of the spots, the great diversity in their size, their symmetry, and the absence of any abrasion over the spot will serve as distinguishing features from bruises caused by violence. In leukæmia, hæmorrhagic spots may be found in many of the mucous membranes. In severe bouts of coughing bruises from the rupture of small vessels commonly occur.

Even the act of violent vomiting or other muscular exertion may cause an effusion of blood. We have seen it in a doctor who accidentally poisoned himself with sodium arsenite.

(ii) In general, in persons who are flabby or out of health, it is well known that a small amount of violence will produce a large bruise, presumably because the vessels are poorly supported by the lax tissues, adipose or otherwise. A boxer who "works off" extraneous fat and "toughens" his tissues can take a lot of punishment without showing bruises.

(iii) When violence causes a bruise below the fascia, or deep amongst the muscles, the effused blood passes in the direction of least mechanical resistance and may, therefore, appear at a considerable distance from the seat of violence, and will take a shape entirely independent of the bruising instrument. It is a very common circumstance for a bruise thus to appear at some distance from a fracture of the leg. Usually the bruise appears at a lower level than the injury, owing to gravity, but the opposite may happen owing to "milking" under pressure at the time of the injury.

(c) *There may be Severe (Fatal) Effusion and no External Bruise or Abrasion.* It has been repeatedly asserted in courts of law that no severe blow could have been inflicted on the body of a person found dead because of the absence of ecchymosis or other indication of violence on the part struck; but, of course, severe lacerations of internal organs with fatal effusion of blood in vehicle accidents, falls, etc., without any external bruising of the skin of the trunk are the rule rather than the exception. It is extremely rare to find bruising of the abdomen after injuries, and the absence of such bruises gives no indication of the possible state of the viscera. The following are typical cases:

The dead body of a man of 29, brought into hospital with a history of a fall from a bicycle, was found to have the mid trunk heavily crushed, the liver split and the diaphragm torn, admitting the stomach into the left chest sac. No external mark of injury was present. Enquiry revealed that he had, wheeled out of a lane into the side of a lorry and fallen under the back wheel, the lorry driver had not reported the accident.

A lorry driver's mate of 40, found dead in a yard where a lorry had backed, was thought to have collapsed and died of some natural cause. There were no external injuries. Autopsy revealed a crushed right lung with haemopneumothorax, a large right perinephric bruise and sub-capsular haemorrhages over the liver which suggested that he had been crushed by a heavy vehicle. It was found, on enquiry, that marks were still discernible on the paint of the tail-board of a lorry suspected to have caused the fatality.

A boy aged eight was brought into the hospital dead. It was reported that he had been knocked down by a heavy cart and was supposed to have been run over. There was not the slightest trace of abrasion or bruising of the skin of the chest nor behind the ribs and sternum, but the upper lobe of the right lung had been cut completely off from the root of the lung and was floating freely in a pleura full of blood.

In the first place, the clothes prevent actual contact of a hard body such as the chassis or the tyres of a motor-car with the skin. This in itself tends to spread the blow, and so to diminish its local concentrated effect. Again, the abdominal parietes if taken unawares, as they are in such cases, are soft and yielding to a broad blunt surface, while the liver, spleen and kidneys *and a full* bladder are comparatively fixed and unyielding, and so suffer laceration, often by being pinched between the applied force and the vertebral column.

As regards the brain, "shear strain" is well recognized as a cause of haemorrhage into the organ and its ventricles (see Brain Contusion).

Even on the limbs it must be remembered that, to lacerate a blood-vessel, a mere compression is insufficient, unless there is a hard resisting surface to give a counter-pressure sufficient to split the vessel or unless there is severe stretching.

7. Abnormal Fragility of Bones. There are quite a number of diseases which may cause undue fragility of the bones. In old age, in rickets and generally in long-standing nutritional disorders and wasting diseases some atrophy of the bones and consequent fragility may occur. Atrophy from pressure and the presence of tumours, cysts, etc., are likely to lead to weakening of bone. Fragilitas ossium and osteoporosis and their relationship to bone formation are matters which need not be discussed here as they are fully described in any text book of pathology.

It is generally accepted that fractures are more readily produced in chronic mental disease. The importance of this condition arises from the fact that when a nurse in a mental hospital is under suspicion of having ill-treated a patient, possibly involving a criminal charge, it is assumed that great violence must have been used if several bones are found to have been broken. The defence made is that no more violence was used than was absolutely necessary, and that the bones broke unusually easily. Radiological examination of the bony tissues may enable the witness to give a decision on this point; if the patient is dead, the presence or absence of any pathological condition of the bones can be established by the *post-mortem* examination: in those confined for a long time to bed, the skeleton tends to become more frail from disuse and relative malnutrition.

Evidence from Examination of the Clothing

This is a most important part of the duty of a medical man. In a case of wounding, he should always see the clothing of the wounded person. It may throw a material light upon the *mode* in which the wound has been produced; it may remove an erroneous suspicion of murder, and may sometimes serve to indicate that a wound has been self-inflicted for the concealment of other

crimes, or falsely to impute its infliction to other persons. Marks of blood, dirt, grass or other substances on the clothing, may also throw a light upon the mode of infliction. The position of bloodstains and direction of flow of the blood may give an indication of the position of the injured person at the time of the injury and his subsequent movements. So, again, the use of a weapon, in reference to cuts and stabs, may be inferred from the dress presenting corresponding cuts or perforations. Contused wounds may, however, be readily produced through the dress, without tearing or injuring it and even considerable laceration of the skin and muscles, with fractures, may be caused without much disturbance of the clothes, supposing them to be of a yielding nature. In self-inflicted or imputed wounds, if of the nature of cuts or stabs, there is often a want of correspondence between the perforations of the clothing and the wounds on the person; this is one of the characters by which the correctness of a statement may be tested (see "Imputed Wounds").

When the question is whether the contused wound resulted from accident or homicide, a careful examination of the clothing may be of great value.

A man was found dead in a stable, not far from a vicious mare, and the harness of the animal was upon his arms and shoulders when the body was discovered. The brother of the deceased was tried on the charge of having killed him with a spade, which was found lying in the stable. This spade was stained with blood, but the evidence from this fact was rendered valueless by the circumstance that the spade had been subsequently used in cleaning out the stable. For the defence it was alleged that the deceased had been kicked by the mare while attempting to put on the traces, and had thus been accidentally killed. There were two clean split wounds, apparently caused by a heavy instrument, on the left side of the head, one about five and the other about two inches long. On the right side of the head there were three wounds of a mixed character, two of them about four inches in length. There was also a wound on the back part of the head, about two and a half inches long. There was no swelling around any of the wounds. The right side of the skull was generally fractured, the fracture extending from the left side. The deceased was found with his hat on, and this was damaged in the parts corresponding to the seat of injury, but was not cut; there were no wounds on any other part of the body. Two medical witnesses expressed a strong opinion that the injuries could not have been produced by kicks from a horse, founding that opinion principally on the character of the wounds, and the absence of marks of contusion. They also thought that they could not have been inflicted without cutting the hat if this had been on the deceased's head at the time; and if the hat had been off, that he could not have had the power to put it on after receiving the wounds. The case was not proved against the prisoner, and he was acquitted.

A

Fig. 23. Shows head injuries
inflicted with a blunt instrument
whilst the victim was wearing a
patterned cloth cap.

(A) shows a detailed impression
of the pattern on the depressed
area of an ash stake found
nearby, together with an inset
portion of matching cap material.

B

(B) Splits in the scalp at the
margins of the depressed frac-
ture, clearly not so much split
along the line of impact as on
the sharp edges of the skull
beneath (C).

C

a trial at the Old Bailey where it had been proved that a cut and a fracture had been received without having cut the hat of the wounded person.

Another instructive case shows the importance of comparing the article of clothing with the injuries which may have proved mortal.

A woman, aged 60, previously quite well, was found dead in her bed. She had vomited slightly, and there were found two wounds about the middle of the right parietal bone, with a large clot of blood in this situation beneath the skin. On removing this clot, the bone was found fractured to the extent of four inches. Nearly three ounces of dark clotted blood were found between the dura mater and the skull. This was the only injury, and quite sufficient to account for death; but a question arose respecting the mode in which this fracture was caused.

It was stated in evidence that on the evening before her death the deceased had been suddenly knocked down by a man accidentally running against her while she was walking in a public road. One witness stated that the deceased fell heavily on the back of her head, on which she was wearing a bonnet. She appeared stunned, was raised up by the man, some brandy was given her, and she recovered sufficiently to walk home and to eat her supper as usual, after which no one saw her until she was found dead in bed on the following morning. Some suspicion arose that the violence done to the head was too great to be accounted for by a mere fall, and it was a question whether, with such an amount of injury, the deceased could have walked to her home, at the distance of a mile and a half, and have eaten her supper before going to bed. At first it was thought that this was a case of murder, and a man who lodged in the house with deceased was suspected. His room was searched, and a hammer with two claws was found. On comparing these claws with the two indentations and fracture the medical witness thought that this weapon would account for the injuries. The deceased and the lodger had been in the habit of quarrelling, and they were the only persons in the house on this occasion. The lodger said that he had let the woman in about nine o'clock (the fall in the road occurred about 7.30 p.m.); her appearance presented nothing unusual, and he saw no more of her until called at seven the next morning, when she was found dead and cold. It was only at the adjourned inquest that the bonnet worn by the deceased at the time of the fall was called for by the coroner. Two indentations were then found upon the back of it, corresponding to those on the skull of the deceased. The indentations on the bonnet contained dust and dirt, thereby confirming the statements of the witness, and rendering it probable that the fall in the road had caused the fatal injury to the head.

The examination of the clothing in this case cleared up what might have been otherwise doubtful. It is probable that the large internal effusion of blood which caused death did not develop far until the deceased had reached home and had her meal. She must have died very soon after she went to bed, as her body was found cold at seven o'clock the next morning. Persons may undoubtedly walk and die at a considerable distance from the spot where serious injury to the head has been sustained, for time is required for sub-membrane bleeding to develop.

During the second world war a number of bodies was brought into a North London public mortuary for identification following an air raid. A police officer undressing them noticed that the knickers of a young girl were inside out: enquiry revealed that she had been found lying inside a front garden a short distance from the other victims. Autopsy revealed that she bore no injury, but was freshly dead from an instrumental abortion. An habitual abortionist, who had shown some opportunism in placing her in the milieu of a raid, was convicted of the offence.

With reference to clothing, it is advisable to have some clear proof that the clothes sent for examination were actually worn by the accused, or that they had belonged to the deceased and were in fact taken from the body.

In *R.* v. *Hotto*, it turned out by the confession of the prisoner, and by the discovery of other articles of clothing in places where he admitted he had concealed them, that the clothes which had been examined were not being worn by him when he perpetrated the murder. In *R.* v. *Munro*, the clothes supposed to have been worn

by the prisoner were sent for examination. There was no blood on the trousers, and it appeared, from the evidence at the trial, that the prisoner had changed this article of clothing before he was arrested.

In a case of suspected murder, one should examine for blood, not only articles of clothing produced by the police, but any others that might have been worn by the accused at the time of the occurrence. In the Road murder (*R. v: Constance Kent*), the omission to inquire minutely in the first instance into all the articles of clothing created several difficulties.

From the nature of the wounds on the body of the infant, it was probable that the clothing of the person who inflicted them would have been stained. She had *three night-dresses, but only two were produced.* When asked for an explanation, she said that one had been lost at the laundry a week after the murder. This was proved to be a falsehood; there was no doubt that the prisoner, soon after the murder, had secreted one of her night-dresses which was stained with blood; she then put out a clean one for the laundry to avoid suspicion, but afterwards clandestinely took this back again to her bedroom. Within twenty-four hours of the murder a chemise wrapped in brown paper and stained with blood was found by a policeman in a fire-hole in the scullery; this was most probably the missing night-dress. *She stated in her confession that she burnt the dress worn on the night of the murder five or six days afterwards.*

A medical man should observe, on these occasions, whether the blood is smeared in large patches on clothing, or whether it is sprinkled, and also make a note of the quantity. The stains may have come as a fine spray from a wounded artery, or from a splashing of blood as a result of violence. He should likewise notice whether, if the wound is in the throat or chest, blood has flowed down in front of the clothes or person, or whether it has *flowed so* as to collect in the armpits, on each side of the neck, or under the back; for these appearances will sometimes show whether the wound was inflicted when the person was standing, sitting, or lying down and, often also, what position the victim adopted after being injured. If the throat is cut while a person is lying down, the blood will be found chiefly on either side of the neck, and not extending down the front of the body. Few suicides cut the throat while in a recumbent posture, and the course which the blood has taken may therefore, help to distinguish a homicidal from a suicidal wound.

The nature of the dried spots of *mud*, fragments of vegetable matter or fibres on clothing may occasionally serve to connect an accused person with an act of murder.

In *R. v. Snipe, et al.*, there were spots of mud on the boots and clothes of the prisoner, which when examined microscopically, presented infusorial shells, some rare aquatic vegetables, and hairs from the seeds of groundsel. The mud of a *ditch* close to which the body of the deceased was found presented the same microscopic appearances as the mud from the prisoner's boots; and the witness who gave this evidence deposed that in his opinion the mud spots were derived from this ditch. He had examined the mud of all the other ditches in the locality and found it to be different.

This circumstance connected the prisoner with the act; and there was corroboration from the fact that he had been seen near the spot on the night of the murder.

In another case Taylor found granules of wheat-starch mixed with the blood-stains on the gaiters of a man charged with murder. Just before the occurrence he had been engaged in sowing seed-corn. Similarly, in *R. v. Steed*, on the soles of the boots belonging to the prisoner portions of farinaceous matter were discovered adhering to the nails, in addition to blood, hair and woollen fibres. After the murder the prisoner had gone into a country baker and flour-dealer's shop, and trodden on the floor, on which there was flour. These facts tended to corroborate evidence that the prisoner was the man seen in the shop.

WAS THE WOUND INFLICTED DURING LIFE
OR AFTER DEATH?

The means we have for determining this important question are all connected with the reaction of *living* tissues to irritants and injuries. If a wound has been inflicted before death, some or all of the following signs will be observed:—

> Free hæmorrhage, externally and into the tissues.
> Retraction of edges of wound.
> Signs of inflammation or of repair.

Hæmorrhage. In another part of this work a full discussion will be found on the cessation of the circulation as a sign of death, also on *post-mortem* bleeding (p. 177). Again, on p. 293, the minute differences between living and dead bleeding (fibrin, evidence of spurting. etc.) are discussed. We shall here concern ourselves more with the *quantity* of the effused blood.

When bleeding from an incised wound is the sole cause of death, the person dies either rapidly, as a result of copious bleeding from the wounded organ or some large vessel, or he dies after some time, in which case, if the wound continues to bleed during the time that he survives, the longer he lives the more copious will be the effusion of blood. In a wound inflicted after death, and while the body is still warm, these features are far less pronounced: one is struck by the comparative absence of bleeding from such wounds, and it would be fair to say that the *quantity of blood lost may assist in determining* whether the wound was made during life or after death. When the body has been moved, and all marks of blood effaced by washing. rules of this kind cannot operate, and the time at which the wound was actually inflicted must then be deduced from other circumstances.

In *R. v. Greenacre*, where the prisoner was convicted of the murder of a woman, this formed a material part of the medical evidence. The head of the deceased had been severed from the body; and the question was whether this severance had taken place during life or after death. The prisoner alleged that it was after death; but the medical evidence was that the head must have been cut off while the woman was living, but after she had been rendered insensible, probably by a blow on that part, the marks of which were plainly visible.

This medical opinion was founded on two observations: The muscles of the neck were retracted, and the head was completely drained of blood, showing that a copious and abundant flow must have ensued during the process of separation, and therefore indicating that the blood continued to flow freely at that time. On cutting off a head after death a quantity of blood may escape from the jugular veins, but this soon ceases. The chief medical witness, Girdwood, expressed himself with proper caution by stating, in answer to a question from the judge, that the wounds in the neck had been inflicted either during life or very shortly after death, while the body still preserved its warmth. The circumstantial evidence showed that the deceased had been stunned, and that her head had been cut off while she was unconscious.

form an opinion on the extent or nature of hæmorrhage, and no opinion should be given without microscopic sections being examined to ascertain the infiltration of the blood into the tissues, the amount of œdema, the presence of leucocytes and other changes produced during life. It is a considerable step in evidence when we are able to assert that a particular wound, found on a dead body, must have been inflicted either during life or *immediately* after death.

A copious effusion of blood has been stated to be a well-marked character of a severe wound received during life; but this observation applies chiefly to cuts and stabs. Lacerated and contused wounds of a severe kind are not always accompanied by much bleeding, even when a large blood vessel is implicated. It is well known that where a whole limb has been torn from the body little blood may be lost; but in such cases coagula or clots of blood are commonly found adhering to the separated parts, a feature which indicates that the wound was inflicted either during life or soon after death while the blood was still fluid and coagulable.

Dissection of vascular parts like the neck and cutting of big vessels, handling and stripping the organs may result in artefacts which are easily mistaken for bruises.[1]

If a bruise has been caused some hours before death, there will be swelling and infiltration of the part with blood, emigration of leucocytes and possibly certain changes of colour in the bruised area, in which case there will be no difficulty in forming an opinion. Although bruising, or an appearance analogous to it, may be produced on a body after death, the changes in colour are then met with only under peculiar circumstances, to be mentioned presently. If the blood found beneath a bruised spot is clotted, it only proves that the effusion must have taken place either before death or very soon after it, i.e., while the blood was still uncoagulated but capable of coagulation. Again, blood effused under a contused wound being *liquid* is not a proof that the effusion took place after death if the autopsy be performed very soon after death, so that the blood has not had time to coagulate, nor is it so if there has been long delay, when it may under a variety of circumstances have become again fluid.[2] Generally speaking, blood coagulates more slowly in the dead body than in a vessel into which it has been drawn *during life or after death*. The blood ordinarily remains fluid in the vessels in a dead body from four to eight or even as long as 12 hours after death. It rarely begins to coagulate until after the lapse of four hours; but if drawn from a blood vessel and exposed to air, it coagulates at once or in a few minutes after its removal.

These general principles must, of course, be qualified by the recent investigations into the presence of fibrinolysins in the blood –both during life, especially after injury or operation, and after death: the blood may never coagulate.[3] This aspect of the problem of *ante* and *post* mortem injury is discussed in detail in the section on "Changes After Death" (see p. 163).

The period of time after death within which a small bruise can be inflicted *so as to resemble one produced during life* has not been fixed with any *degree* of precision. Christison found that blows inflicted on a dead body not more than *two hours* after death gave rise to appearances on the skin similar to those which resulted from blows inflicted on a person shortly before death, but that at this period it was often difficult to produce a bruise. He found

[1] Prinloo, E., and Gordon, I., 1951. *S. Afr. med. J.*, 25, 358.
[2] MacFarlane, R. G., and Biggs, R., 1948. *Blood*, 3, 1167.
[3] Mole, R. H., 1948. *J. Path. Bact.*, 60, 413.

that dark fluid blood might be effused into the subcutaneous cellular tissue so as to redden it, but this effusion was never extensive. It follows that, by trusting to external appearance only, contusions made soon after death may be confused with those which have been produced by violence shortly before death.

The similarity may be so strong if the experiments are performed within half an hour, or even an hour after death, that it is difficult to state positively whether the blow producing the discolouration has been inflicted on a living or on a dead body. Christison's experiments lead to the conclusion that *severe* blows inflicted on a body recently dead produce no greater degree of ecchymosis, or cutaneous discolouration, than *slight* blows inflicted on the living. Assuming that the great extent of spread of a bruise would in all cases serve to show that it had been inflicted during life, it must be remembered that the importance of these facts in relation to medical evidence is not affected by the size of the injury. Slight ecchymoses, as in cases of strangulation or suffocation, if they can be certainly pronounced as *ante-mortem*, may make all the difference between the acquittal and conviction of a person charged with murder. Slight ecchymoses on the bodies of the drowned may excite a suspicion of strangulation prior to immersion of the body in water and an infant may be killed by violence, though only a few slight marks of bruising be found upon its body.

As a rule, however, a bruise inflicted before death shows frank infiltration of the tissues with blood; that is to say the blood is actually forced in amongst the tissues. No amount of violence inflicted after death can accurately reproduce this appearance (which depends on the pressure of the beating heart) until the tissues are disturbed, torn or stripped at autopsy.

If considerable violence were used after death it is quite possible that a certain number of cells might be driven from the ruptured capillaries into the tissues, enough possibly to confuse the issue in the examination of a microscopic section. In general, however, the difference is quantitative rather than qualitative, and the amount of the extravasation and its distribution should be sufficient to warrant a definite opinion from an experienced observer. (Edema, which may develop rapidly, is a useful guide.)

In *R.* v. *Cornock* (Bristol Assizes, 1947) six bruises found on the head of a man found bound by the wrists and ankles, drowned in his bath, were alleged by the Crown to have been caused by his being struck by a toy boat. The defence, consulting Spilsbury on the matter, made *considerable use of the argument that so restricted was the escape of blood into the connective tissues of the scalp that they must have been post-mortem injuries* —and might well have occurred during attempts by a cripple and the accused wife to get the body out of the bath and into an adjacent room for resuscitation. The dead man was known to be a masochist. Mrs Cornock was found not guilty.

For details on the differences between bruising and *post-mortem hypostases* vide "Hypostases". (p. 175).

Retraction of Edges of the Wound. The healthy skin is, during life, slightly on the stretch; the muscles are, too, in a similar condition of "tone". Consequently, if, in a wound on a dead person, we find the skin gaping and the muscles retracted in a manner which cannot be accounted for by the effects of *rigor mortis*, we are justified in asserting that the wound was inflicted *either during life or very soon after death*, while the skin was still supple and the muscles were still contractile (provided the wound is not in such a position and of such extent that the mere weight of the parts might open it out).

On this point as well as incidentally on the other points the *following* experiments by Taylor are still apposite:

In conjunction with Aston Key, Taylor performed some experiments on recently amputated limbs. *Two minutes* after a leg had been amputated a deeply incised wound was made in the calf. The moment the wound was made the skin retracted considerably, causing a protrusion of the adipose substance beneath; the quantity of blood which escaped was small, and the cellular tissues by their sudden protrusion forwards, seemed mechanically to prevent its flow. The wound was examined after the lapse of twenty-four hours; the edges were red, bloody, and everted; the skin was not in the least degree swollen, but merely somewhat flaccid. On separating the edges a small quantity of fluid blood escaped, but no coagula were seen adhering to the muscles. At the bottom of the wound, however, there was a small quantity of coagulated blood; but the coagula were so loose as readily to break down under the finger. In a second experiment *ten minutes* after the separation of the member from the body, a wound of similar extent was made on the outer side of the leg, penetrating to the deep-seated layer of muscles. In this case the skin appeared to have already lost its elasticity, for the edges of the wound became only slightly everted, and scarcely any blood escaped from it. On examining the leg twenty-four hours afterwards, the edges of the incision were pale and perfectly collapsed, presenting none of the characters of a wound inflicted during life. At the bottom of the wound, and enclosed by the divided muscular fibres, there were some coagula of blood; but these were fewer than in the former experiment. A portion of the liquid blood had evidently escaped, owing to the leg having been moved. Other experiments were performed at a still later period after the removal of the limbs, and it was found that in proportion to the length of time suffered to elapse before the production of a wound so were the appearances less distinctly marked; that is to say, the less likely they are to be confounded with similar injuries inflicted upon a *living* body. When the incised wound was not made until *two or three hours* after the removal of the limb, although a small quantity of liquid blood was effused, no coagula were found.

These observations have acquired new interest since the work of Macfarlane and Biggs[1], and others, on fibrinolysins affecting the coagulability of blood.

Signs of Inflammation. Inflammation is a process which can only be carried on by living tissues; if the vicinity of a wound shows any swelling, effusion of lymph or pus, adhesion of the edges, it not only indicates that the wound was inflicted during life, but it may also give some indication as to the time when it was inflicted (see p. 246).

Signs or Repair. Scabs, granulation tissue or the growth of epithelium over a wound, prove conclusively that it was inflicted some considerable time before death. The processes of repair in damaged tissues have been well reviewed by Payling Wright.[2]

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[1] Macfarlane, R. G., and Biggs, R. 1948. *Blood*, 3, 1167.
[2] Wright, G. P., 1954. An Introduction to Pathology. 2nd Ed. London: Longmans Green.

HOW LONG DID THE VICTIM SURVIVE?

The effect of the passage of time on wounds in the living has already been discussed (p. 246). When a person is found dead the question still maintains its importance, but from rather a different point of view, for it is now not so much a question of duration of survival, but rather of what the victim could have done after receiving the wound.

Acts of Volition after an Injury

It is obvious that this question can hardly arise in connection with a large number of injuries. Victims have been known, however, to drag themselves considerable distances after most extensive injuries, and the problem of volition after injury demands close attention. We shall discuss:—

Injuries to the head and brain.
Injuries to the throat; speech after the throat is cut.
Injuries to the heart.
Rupture of abdominal viscera.
Violent struggling after injury.

Injuries to the Head and Brain. Cases frequently occur in which a patient who has received a blow on the head survives several hours or days, although the injury to the cranium might have been expected to have caused death almost instantly. On the other hand, a person may fall dead from a blow which produces no appreciable physical changes in the cranium or its contents. It is by no means easy to determine from an examination of a wound in a dead body how long a person might have lived after its infliction. But it must not be assumed that an opinion on this subject is never to be expressed from the nature and extent of an injury; what should be impressed upon a medical witness is, that it must not be hastily given. A wound may be mortal, but it by no means follows that it must have caused death instantaneously.

A girl of seven ran off the pavement into the side of a private car and was thrown to the ground. She was dazed but conscious, sat on the kerb until the arrival of the ambulance, and walked into it. About twenty five minutes after the accident she walked out of the ambulance into the Casualty Department of an L.C.C. Hospital—and was found to have the handle of the car door penetrating the skull behind the right ear, to a depth of nearly three inches. She remained fully conscious until anæsthetized but died upon withdrawal of the handle from the lateral sinus which it had plugged.

The medical opinion, in an abstract question of this kind, is commonly based on individual experience, but the real question is not whether the witness himself has seen such a case, but whether such a condition of things is possible. A witness is allowed to express an opinion from commonsense, professional knowledge and experience.

The fact that a person after being concussed by a blow on the head sometimes recovers consciousness and performs acts of volition, but subsequently becomes unconscious again, is an ordinary point of differential diagnosis between extradural hæmorrhage—i.e., bleeding between the skull and the dura—and cerebral contusion, bruising of the brain itself. The "lucid period" is an important forensic event.

A girl was brought into the London Hospital with the left internal jugular vein cut through and the left common carotid all but severed. Her throat had been cut by a jealous lover, who had also gashed the back of her neck. Notwithstanding these severe wounds, she had run about sixteen yards into a public-house before falling down. She died in about two minutes.

Speech is assuredly an act of volition, and the question of whether or not a person with his throat cut can speak is one of great importance, for if he be unable to use his voice so as to call for assistance murder may, in this way, be quietly committed without persons in an adjoining room hearing any noise, and the fact is that when the windpipe is divided, as it generally is on these occasions, the voice is usually lost.

Harvey Littlejohn,[1] however, quotes a most unusual and instructive case in this connection. A woman cut her throat, the windpipe being completely divided two inches *below* the vocal cords. On the arrival of a physician she was sensible, and said that she had torn a tumour out of her neck because it was choking her and that she wanted to die.

She died shortly afterwards. Littlejohn found that the trachea was cleanly cut through and that the upper end of the divided tube projected from the wound together with six and three-quarter inches of the œsophagus. Beside her was a small tumour, consisting of the right lobe of the thyroid gland, which she had torn out with the gullet. In this case the woman was able to speak after cutting the trachea *below* the vocal cords.

In another case[2] a boy's throat was cut across and the larynx divided just *above* the vocal cords. The wound severed the facial and lingual arteries and also divided the anterior wall of the œsophagus. Shortly after the infliction of the injury he was alleged to have spoken and made a statement involving certain persons. The nearest medical officer did not arrive till after the boy was dead. He saw the injuries and held the *post-mortem* examination. He gave his opinion that the gaping wound of the throat rendered speech impossible from the moment of its infliction. Medical opinion to the contrary was, however, obtained by the defence. It was stated by this authority that, the wound being situated *above* the vocal cords would not have prevented the boy from speaking fairly loudly and fairly distinctly, though the voice would naturally grow fainter as the boy gradually succumbed owing to loss of blood.

In such a case the voice of the victim would be much impaired, but even though the injury to the larynx were very complete and the wound gaped greatly, yet a portion of the expired air might pass into the mouth and give rise to sufficient voice to be heard and understood.

Wounds of the Heart. Penetrating wounds of the heart are often considered to be instantaneously fatal but experience has shown that this is erroneous. The size and direction of wounds entering the heart is all-important in relation to the period of survival.

When the cavities of the heart are extensively torn or penetrated, death is likely to be immediate, but persons who have sustained wounds of a lesser caliber have frequently lived sufficiently long to exercise powers of volition and locomotion.[3]

Watson met with a case in which a man who had been stabbed in the right ventricle ran 18 yards after having received the wound. He then fell, but was not again able to rise; he died in six hours. On dissection it was found that a punctured wound had extended into the right ventricle in an obliquely transverse direction, dividing in its course the coronary artery. The pericardium was nearly filled with blood, and about five pints were effused on the left side of the chest.

[1] "Forensic Medicine", 1925, J. & A. Churchill, London.
[2] *Lancet*, 1909, 1, 1501.
[3] Sanson, P. C., 1918, *Ann. Surg.*, 127, 1127

Darling, of New York, had a case which occurred in 1855, in which a man survived for a period of 11 *days* a bullet wound of the heart. A bullet, one-third of an inch in diameter, was found lodged in the fleshy partition between the right and left ventricles, about midway between the apex of the heart and base of the ventricles. There was no communication with the cavities; the wound had entirely cicatrised and inflammation of the pericardium was obviously the cause of death.

In 1854, an Italian, *æt* 38, discharged a brace of pistols into his chest on the left side. The man was brought into Guy's Hospital, and was *able to converse on* his condition, and *lived one hour and fifteen minutes* after the infliction of the wound. After death it was found that one bullet had perforated the pericardium, entered the right ventricle, and, after traversing the septum of the ventricles, made its exit from the heart at the junction of the left auricle with the ventricle. It traversed the upper lobe of the left lung, and was found fixed in one of the vertebræ. The second bullet perforated the left ventricle, and then traversed the left lung. This wound was of such a nature that, at every contraction of the ventricle, the opening must have been closed so as to arrest the flow of blood. This man, owing to severe suffering, rolled about the floor, and was with difficulty kept quiet.

In cases where the ventricle wall is not completely perforated or where the penetration is slanting, thin, and therefore tends to become "valvular"—or even to close upon contraction of the muscle, little or no blood probably escapes from the heart in the first instance, but it may afterwards continue to ooze gently, later reaching a fatal quantity. It must not, therefore, be supposed when a person is found dead with a wound of the heart, attended with abundant hæmorrhage, either that the flow of blood took place in an instant or that the person died immediately and was utterly incapable of exercising any voluntary power. Only one condition will justify a supposition of this kind; namely, when the cavities of the heart are laid widely open. This remark applies especially to wounds of the auricles which are thinner and incapable of "valvular" closure.

Of late years many cases have been reported in which recovery has taken place after wounds of the heart. We have seen a man survive five *stab* wounds over the heart, three of which penetrated it. If the hæmorrhage occasioned by the injury is not sufficient to cause death by the embarrassment of the heart, the organ is able to function, and to undertake a large amount of repair; though there is always a danger of the ultimate formation of an aneurism, a good firm scar is by far the more likely.

Ruptures of the Diaphragm. A rupture of the *diaphragm* has been considered sufficient to incapacitate a person but still in some cases the power of moving and walking may be retained after a rupture of this muscle. In the following instance, reported by Devergie, the proof of locomotion was material:—

An intoxicated man, after having been maltreated by another, returned home, walking for at least two hours with two companions. The man died in fifteen hours; and on inspection, among other severe injuries, there was found a recent longitudinal rupture of the diaphragm about two inches and a half in extent; the stomach protruded through the aperture.

There was no evidence to show that the deceased had been attacked or beaten by his two companions in journeying homewards; and, therefore, there could be no reason for inferring their guilt simply because locomotion after such an injury was something unusual as a matter of medical experience.

In a case admitted into Guy's Hospital, the patient survived for at least *nine months* the only accident which could have produced the rupture.

The man had fallen on the deck of a vessel from a great height six months prior to his admission. His ribs were fractured, and one ankle was so injured as ultimately to render amputation necessary. He died three months after admission; and on inspection it was found that the stomach and the colon occupied the left side of the chest, having protruded through an aperture in the muscular part of the diaphragm, two and a half inches in extent. This hernia was evidently of old standing, as the aperture was cicatrised, and the omentum adhered to it. The existence of this injury was quite unexpected, and at the time of admission there was nothing to interfere with locomotion and exertion except the injury to the ankle.

This injury is far from being immediately fatal and a great many cases have been recorded of complete recovery after rupture.

Ruptures of the Liver, Spleen, or Kidneys, unless followed by great loss of blood, do not prevent a person from exercising muscular power.

Ruptures of the Bladder. In ruptures of the *bladder* attended with extravasation of urine, a question may arise respecting the retention of the power of locomotion. The following cases will show that this power exists.

A man, *æt* 31, while intoxicated, received a blow on the lower part of his abdomen. He was sobered by the accident, and walked home, a distance of a quarter of a mile, although suffering severe pain. He died four days after the accident. On inspection there was no mark on any part of the abdomen. The bladder was ruptured in its upper and back portions for about an inch.

A gentleman who had been compelled to retain his urine fell accidentally in descending a staircase, with the lower part of his abdomen against the edge of one of the steps. The sense of fulness in his bladder immediately ceased, and he walked to a friend's house to dinner. The nature of the accident was mentioned to a surgeon who was there, who immediately suspected that the bladder must have been ruptured. The case terminated fatally in twenty-four hours.

A case is reported in which a man walked a distance of two miles after having sustained a rupture of the bladder; and in another the man, who sustained the injury in a scuffle, was able to walk for between two and three hours afterwards.

The medico-legal implications of this subject will be apparent from the following case:—

A man passed some hours convivially with a few friends, after which a quarrel ensued, blows were exchanged, and the parties wrestled with each other. The deceased then walked home, a distance of more than a mile; and in crossing the threshold of his own door he fell forwards on his abdomen. When lifted up he complained of great pain, and was put to bed, being quite unable to exert himself. He died in two days, and upon dissection the bladder was found ruptured at its upper part (fundus) to the extent of between two and three inches. In these circumstances, it becomes a question whether the rupture was caused by the violence of his companions, or by the accidental fall at the door of his own house. If by his companions, he must have walked more than a mile with his bladder ruptured; but two medical witnesses declared that he could not have walked this distance after the rupture, and consequently that it must have been occasioned by the subsequent fall.

It would, in this case, appear that the symptoms of rupture and extravasation of urine occurring immediately after the fall rendered it highly probable that this accident was really the cause. It is obvious that the power of locomotion may be exerted in such circumstances to a much greater extent than is commonly supposed.

Struggling after Severe Wounds. The power of moving after severe injury, if not considerable, may be retained and is occasionally a material

question in legal medicine. It must not be lost sight of when we are drawing inferences as to the relative positions of an assailant and a murdered person from the situation in which a body is found. A dead man with mortal injury to the head or heart may be found lying on his face when he actually fell upon his back. He might still have retained sufficient power to turn over before death; or he may have fallen on his face, and have afterwards moved, so that his body may be found lying in another position. Local movements of this kind are commonplace. Individuals suffering from mild concussion have been frequently known to perform acts unconsciously and automatically. The medical witness must bear in mind that he is not required to state in how many this power of performing acts of volition and locomotion may remain, but simply whether the performance of these acts is or is not *possible*. It is on this point only that the law requires information. A hypothesis of guilt, when we are compelled to judge from circumstances in a doubtful case, can only be accepted on the exclusion of every other reasonable explanation of the facts. In legal medicine, medical experience, however rare, admits of a very important and significant application: remote possibilities have an important place when it comes to assessing other explanations of events at trial.

Although, in cases of *severe wounds*, we may agree that persons may survive for a sufficiently long period to perform various acts of volition and locomotion, yet the presence of a mortal wound, especially when accompanied by a great loss of blood, must prevent struggling or violent exertion on the part of the wounded person; such exertion we may consider to be incompatible with his condition. A medical jurist may thus have it in his power to determine something of the circumstances and to judge something of the veracity of the statements made in cases of this kind.

A man was tried for the murder of a woman at Liverpool by stabbing her in the chest. The prisoner and the deceased, with two other women, were quarrelling in the passage of a house. A struggle ensued between the prisoner and the deceased, which one of the witnesses said lasted for *ten minutes*. When the prisoner had reached the door, he pulled out a knife and stabbed the deceased in the chest. She fell, and died almost immediately. The prisoner alleged that he was attacked by several persons, and that he stabbed the woman in self-defence. The judge said that if the blow had been struck with premeditation before the struggle, the crime *would be murder; if during the struggle, it would be manslaughter. The medical evidence showed that the blow could not have been struck before the struggle, because it was of a speedily mortal nature; and the deceased would not then have been able,* as it was deposed to by the witnesses, to struggle and exert her strength with the prisoner for *ten minutes* afterwards. This being the case, it followed that *in all probability the deceased had been stabbed towards the conclusion of the quarrel; it might have taken place while the prisoner was attempting to defend himself.* The jury returned a verdict of manslaughter.

This question was also involved in *R. v. Hobbs.*

The prisoner was indicted for the wilful murder of a man with whom he had been drinking and quarrelling. It appears that in the early part of the quarrel the deceased threw the prisoner down and struck him. The deceased was told by the landlord of the inn to go home. He replied, "Very well," and then, leaving the prisoner, went through the entrance gate of the inn up the yard. In about *seven minutes* the deceased, who had complained to the landlord of the maltreatment which he had undergone, returned into the inn-yard, and was seen on entering it to pull down his waistcoat and button his coat. A witness advised him to go home, and he left the spot. A short time afterwards he was found at the back of the yard lying dead on his face. On examining the body it was ascertained that the deceased had been stabbed in two places, one of the stabs having penetrated a ventricle of the heart. On arresting the prisoner a large clasp-knife was found in

his pocket, stained with blood. The prisoner admitted that he had stabbed the deceased, but said it was *during the quarrel*, and that he had used the knife in self-defence while they were on the ground. For the prosecution it was alleged that the deceased had been stabbed by the prisoner subsequently to the quarrel—that he had gone through the gate into the yard to meet the deceased, had there stabbed him, and had caused his instant death. A medical witness who was called stated at first that from such a wound death must have been *instantaneous*. In cross-examination, however, he admitted that the deceased might have lived some time after he had been stabbed; and on this evidence the prisoner was convicted of manslaughter.

The medical facts of the case are imperfectly reported; hence it is difficult to give a definite opinion respecting the time at which the deceased was stabbed in the heart. The size of the stab in the ventricle is not stated, nor was it evident whether any blood was found on the spot where the deceased was struggling with the prisoner. Taking the facts as reported, it would appear probable that the deceased was stabbed by the prisoner subsequently to the quarrel, while he was walking in the inn-yard. The only circumstances in favour of the defence were the prisoner's statement and the fact that, in some cases, wounds of the heart do not prove immediately fatal.

In *R. v. E. M. Brown*, the prisoner was charged with the murder of her husband by blows on the head while in her room, but she insisted that the violence on the head was produced by the kick of a horse. The medical evidence showed that the bones of the nose were broken; there was a stellate wound exposing the bone above the left eyebrow, another similar wound exposing the bone at the top of the head, and a third wound at the back of the head. The left ear was perforated; and behind it was a long wound divided into two. The skull vault was fractured from the orbit through the parietal into the occipital bone. Seven pieces of bone, varying in size from half an inch to three inches, had been driven into the brain, and a large quantity of blood was effused. The prisoner's account was that she found her husband thus wounded and bleeding outside the house, that she dragged the body into an inner room, and, further, that, though thus wounded, he held her tightly by the clothes for two hours afterwards. It was proved that there was no blood over the front of the person or dress of the deceased, and that there was no blood in the passage or in any part of the house, except in the room where the body was found lying. Further, the injuries were not such as a kick from a horse would produce, and the medical witness said that a man thus injured could not have held the prisoner by the clothes for two hours, so as to prevent her from seeking earlier for assistance. These facts showed that the deceased had been killed by blows where the body was actually found. The prisoner was convicted.

ACCIDENT, SUICIDE OR HOMICIDE?

It may at first sight be felt that the determination of a question of this nature is largely outside the province of a medical witness. In some instances it may be so, and the decision is then left to the police and legal authorities; but in a large number of cases it is so closely dependent for its elucidation on medical facts and opinions that a jury could not arrive at a satisfactory decision without medical evidence. The medical examiner in cases of this nature should direct his attention to everything connected with the body, the clothing and the place where the body was found, as follows:—

1. **The position and lie of the body:** evidence of disturbance.

2. **The medico-legal nature of the wounds.**

    (*a*) *Suicidal v. accidental wounds:* general.

    (*b*) Evidence from the *situation* of the wound.

    (*c*) Evidence from the *nature and extent* of the wound.

    (*d*) Evidence from the *direction* of a wound.

    (*e*) Evidence from *multiplicity* of wounds.

3. Foreign bodies in wounds.

4. Evidence from the surroundings: blood marks; footprints, finger-prints, etc.; disorder or damage to the furniture.

5. Evidence from the weapon: position, character, bloodstains, hairs and other foreign matter adherent.

FIG. 24. Evidence from the position of the body. An elderly man found gagged and bound on his shop premises, dead. The exact position of the body, especially with regard to the gags and the lie of the face, and the precise man-ner of pinioning by cords form important parts of the evidence. The victim had been "coshed" and left in such a way as might well cause death.

6. Evidence from an examination of the assailant.

The following brief epitome is inserted as a useful guide to the arrangement of the facts for reports:—

Evidence may be derived from:—

POSITION OF BODY AND CLOTHES.

A body gagged and bound, with the clothes disarranged or torn away (evidence of a struggle) is *primâ facie* evidence of homicide. Note the amount and especially the position of the blood, and consider how it became distributed so.

WOUNDS:—
Number.

Many slight wounds often indicate suicide; if two or more important organs are wounded a more sinister

. event is likely. Many wounds on hands are usually from attempts at protection. Many deep · wounds suggest homicidal savagery.

Position.

Suicidal wounds are almost invariably on the front of the body, but there is hardly a position, even in the back, in which a lunatic may not contrive to wound himself. Hammering on the head, driving in of nails, chisels, etc., are lunatics' tricks. Genital wounds are more common on women, and usually sadistic.

Nature.

Blunt injuries are rarely suicidal except in lunatics; but dynamite in the mouth and red-hot irons driven into abdomen are occasionally resorted to by suicides. Strangling by the hand cannot be suicide.

Direction and depth.

A cut is usually shallower at its termination, indicating whether a wound was made from left to right or vice versâ. An assailant's hand, coming from behind, cuts the throat like one's own hand starting in front.

Homicidal cut throats are usually bolder, more widespread and more undercut; suicidal cut throat wounds usually run elliptically: "tentative" cuts are usual.

A determined suicide may often cut down to the spine in cutting his throat; the sharpness of weapon and the strength of the victim must be considered.

Bruises, fingernail-marks, etc.

These demand explanation either from the nature of attack or defence.

Direction of flow of blood.

Often gives a strong clue to the position of the victim at the time of, and after, injury.

SURROUNDINGS:—
  Furniture.

In disorder, or broken, with fingerprints on it as evidence of struggle. Blood or hair attached.

  Floor.

Stains. Dusty or bloody footsteps. Foot prints.

  Weapon.

Exact position. Nature. Blood or hair on it; whether gripped firmly in the hand; if absent, whether thrown away or hidden.

THE ACCUSED.

Blood stains on the clothing, scratches and any minor injuries, as evidence of a struggle. General physical condition. Any obvious mental disturbance.

The Position and Lie of the Body

Evidence of Disturbance. It is important that there should be no disturbance of the body, of the weapon, of articles of furniture, or of other matters in the immediate vicinity. If the position of the body or the weapon has been carelessly interfered with, or the arrangement of the clothes altered, this may materially affect a medical opinion.

A pathologist performing a routine autopsy on a woman 'found dead in bed' by her husband found no significant natural disease. The blood, which was bright cherry red, contained 64 per cent of carbon monoxide. *No gas was laid on in that room.* She could not have got into bed saturated to that degree. The husband, questioned more closely, admitted that he had found her in a living room downstairs lying on the hearthrug with a gas tube leading to her face and had carried her to her bed to avoid the stigma of suicide.

If the position of the deceased with respect to surrounding objects has been disturbed, if the weapon has been removed, and the body transported to a distance, then it may not be easy to distinguish a wound accidentally received from one inflicted by a suicide or a murderer; and the evidence of those who find the body can alone clear up the case; and the medical witness may be required to state how far this evidence is consistent with the situation, extent and direction of the wound by which the deceased has fallen. Before a body is moved, a photograph must, wherever possible, be taken of the attitude, the clothing and position of surrounding objects in relation to it—of blood stains and any other relevant data.

Medico-legal nature of the Wound or Wounds

(a) General facts. Suicidal and Accidental Wounds. It is not often that any difficulty is experienced in distinguishing a *suicidal* from an *accidental* wound. When a wound has been suicidally inflicted, it usually follows traditional lines, and gives clear indications of design; the whole of the circumstances are seldom reconcilable with the supposition of accident. Circumstantial evidence is usually sufficient to show whether a wound has been accidentally inflicted or not; but as an accidental wound may sometimes resemble one of homicidal or suicidal origin, so, if the body has been disturbed, it follows that it is not always possible for a medical witness to decide the question from a mere inspection of the wound.

A woman was found dead face down in a forest hollow near Groombridge. Her body was removed to the local mortuary where a pathologist found that she had a severe blunt injury to the front of the throat across the voice box, with fractures. Suspicion of foul play naturally arose and it became vital to know exactly how she had been lying, face down, when found. No photograph, nor any descriptive record, had been taken before the body had been moved, and those who had found her could not remember exactly how she lay: the case thus remained obscure.

A witness must be prepared, in all cases in which death has taken place in secrecy, and the nature of the wound is such as to render its origin doubtful, to be closely examined by counsel for a prisoner charged with homicide on the question whether the wound might not have been accidental. The law requires that it should be made quite clear to a jury, before such a charge

can be sustained, that the fatal wound could not have had an accidental or suicidal origin.

The death of a person from wounds has hitherto been considered as a subject connected with a criminal charge; but an investigation of the circumstances in which death ensues is occasionally rendered necessary when the deceased has effected an insurance upon his life. A policy of life insurance is in some cases rendered void by the act of self-destruction; and therefore a person bent on suicide might, for the sake of his family, take precautions to conceal the manner in which he intended to take his own life. His body might be found wounded in such a way which would render it uncertain whether he had been wounded accidentally, whether he had been murdered, or whether he had fallen by his own hand. It is incumbent on the insurance office in a disputed case to prove the act of suicide, whereas the relatives of the deceased would attempt to show the contrary. Such litigation must, of course, call forth a searching investigation into all the circumstances connected with the death of the insured, and the whole case would, in some instances, rest almost exclusively on medical evidence.

In September, 1926, a man and his wife were found apparently burnt to death in a motor-car. It was assumed at first that the car had taken fire by accident, but investigation showed that the man had shot his wife, and had poisoned himself, after which he saturated the car with petrol and set fire to it.

Though severe incisions over vital parts do not often happen by accident, severe punctures and stabs affecting vital organs have frequently an accidental origin. These stabs arise generally from falls while the person is in the act of running with a pointed instrument in his hand or his pocket. They are commonly directed from below upwards. Homicidal stabs may likewise be directed from below upwards; but this is somewhat rare in this country, unless the person is stabbed by an oblique blow while in the recumbent posture.

The fact that there may be some instances in which rules of this kind will not be applicable must not prevent the cautious application of them in doubtful cases. The following cases show how accidental may resemble homicidal stabs:—

A blacksmith, while forging a piece of rod-iron, was irritated at some observations made by a bystander. He made a rush at the offender with the heated iron in his hand, the end being red-hot; he stumbled and fell. In some way the piece of iron became accidentally reversed; he fell upon the red-hot point, which struck against a portion of the breast-bone, glanced from that, and penetrated the upper part of the left lung. He died in a few days. If only one person had been present when this circumstance occurred, a charge of murder might easily have arisen.

no signs of having been wounded, and did not complain of having been struck by the weapon. These facts seemed to show that the stab must have taken place after the quarrel; it was further proved that the wounded man had the chisel in his pocket before the quarrel, and that, as the outer coat had not been cut, a homicidal stab could only have been inflicted by the assailant's lifting the coat, which was altogether improbable. The man recovered, and from the statement which he made there could be no doubt that it was an accidental stab produced by a fall; but it was certainly extraordinary that it should have been found in such a situation and taking such a direction.

If the wounded person were in a helpless state of intoxication at the time, stabs or punctures might occur of which he might be entirely unconscious. The case further illustrates the importance of examining the clothing.

(b) **Evidence from the Situation of a Wound.** Suicidal wounds are generally in *exposed* and *easily accessible* parts of the body such as the throat and front of the forearm for incised wounds, over the region of the heart for stab wounds, and in the centre brow, the temples, the mouth, or over the heart for firearm wounds.

It is obvious, however, that any of these parts may be selected by a murderer, *with the especial design of simulating a suicidal attempt; therefore the mere situation of a wound does not suffice to establish the fact of suicide.* It might be thought in reference to pistol wounds, that if the weapon has been introduced into the deceased's mouth, and there discharged, we might take it for granted that it was a suicidal act, but this inference must not be too hastily drawn, because it is within the range of possibility that a calculating assassin might purposely resort to this method of killing a person. Some have regarded it as fully established in legal medicine that when wounds lie over the back of the body it is sufficient proof that they could not have been self-inflicted. This situation is certainly unusual in cases of suicide; but, as Orfila observed, it is not the situation so much as the direction of a wound which furnishes evidence against the presumption of suicide. A wound, traversing the body from behind forwards in a direct line, is not likely to have resulted from a suicidal attempt; at least, it must be obvious that it would require more preparation and contrivance so to arrange matters that such a wound should be produced than is at all likely. An insane person, however, often makes elaborate preparations; when this is so, there is usually plenty of general evidence to the effect. Nevertheless we must not always expect to find suicidal wounds in what would appear to be the most appropriate situation to cause death rapidly and painlessly. A lack of knowledge or a lack of resolution on the part of a suicide, or the accidental slipping of the hand, will often cause a wound in a place where we might least expect to find it. Suicidal wounds sometimes have the most unusual features.

A bank manager was found dead in his bedroom, a ·32 revolver clutched in his right hand. He lay on his back, dressed in pyjamas, with a single entry wound consistent with the discharge of a weapon of this calibre *on the top of his head.* The room was locked on the inside and he had left a note indicating his intention of committing suicide. The bullet had passed through the foramen magnum into the spinal canal, lying embedded out of sight within the vertebral column at the root of the neck.

A man of 66 was found dead on his back in a single apartment room he occupied in an East End tenement; blood had been noticed trickling into the corridor under the door. There was considerable disorder, a table overturned and blood splashed and smeared widely around. The penis had been amputated roughly and two parallel incised wounds lay on the right side of the neck, each some three to three and a half inches in length, dividing the external jugular vein.

Inspection revealed the thickened everted edge of a cancerous growth around the edges of the root of the penis which had been roughly amputated by the victim who had afterwards cut his own throat. A bloodstained knife lay in a drawer, partly wiped. His sister gave evidence of threats to perform such an act.

It is rarely that we find suicidal stabs in the throat, but it is much more common to find them in the upper abdomen, the heart—often felt beating in the "pit" of the stomach—being the objective. In regard to situation, there is no wound which a suicide is capable of inflicting upon himself which may not be produced by a murderer; but there are many wounds inflicted by a murderer which, from their situation and other circumstances, could not be self-inflicted: the precise election of a classical suicidal site is a strong indication of deliberate self-inflication.

The situation of a wound rarely serves to show whether it is of an *accidental* nature or not. Accidental wounds generally exist on those parts of the body which are exposed, but may equally penetrate the clothing.

(c) **Evidence from the Nature and Extent of a Wound.** Generally speaking wounds found on the body of a suicide, apart from those by firearms, are either incised or stabbed. Contused wounds are rarely seen in cases of suicide, because in producing them there is not that probability of causing death speedily which a suicide usually desires. There are, of course, exceptions to this remark, as where, for instance, a man precipitates himself from a considerable height, or in the path of a train. Circumstantial evidence will, however, rarely fail to clear up a case of this description. When death is caused by a contused wound voluntarily inflicted, the victim is likely to have been insane.

A case is related in which a man first attempted to kill himself by running his head against a wall, and not having succeeded in the attempt, he struck himself repeatedly on the forehead with a cleaver. By this he produced such violent injury to the brain that death soon followed. The man was seen by several witnesses to commit the act. If this had not been the case, the nature of the wound would certainly have justified the view that it had been criminally inflicted by another.

A close attention to the slope, depth and direction of a wound in the throat made by a cutting instrument will sometimes lead to a definite conclusion in a case rendered doubtful from the circumstances in which the dead body of a wounded person is found. The elementary distinctions between suicidal and homicidal throat wounds may be tabulated thus:—

Suicidal	*Homicidal*
1. Across the front of the throat, less commonly on the side, very rarely at the back. High level.	More commonly on the sides, occasionally round the back. Lower level.
2. Marked by tentative cuts at the beginning of the main wounds.	No tentative cuts.
3. Sloped up, if at all.	Sloped down, if at all.
4. Gradual deepening and shallowing.	Boldly cut in at commencement.
5. Curved across the throat.	Straight or set obliquely downwards.
6. Main wound may contain several deep cuts.	Main wound usually solitary—but sometimes repeated parallel wounds.

7. Often accompanied by wounds across wrists or vital parts elsewhere.

Unaccompanied by wounds to wrists but often associated with other severe injuries.

8. Weapon may be firmly grasped, in the hand.

Weapon not firmly grasped in the hand but may be loosely placed there to simulate suicide.

9. No cuts to hands unless open (e.g., razor) blade between fingers.

Frequent "protective" cuts in wrinkled skin of grasping surfaces of hands, or on backs.

10. The weapon should be present.

The weapon is sometimes present but usually removed by the murderer.

The following cases illustrate the application of these guiding principles:—

The body of a farmer was found lying on the high-road. His throat had been severely cut, and he had evidently died from the bleeding which had taken place. A bloody knife was discovered at some distance from the body, and this, together with the fact that his pockets had been rifled, led to a suspicion of murder. The suspicion was confirmed when the wound in the throat was examined. It was cut, not, as is usual in suicides, by carrying the cutting instrument across the front of the throat backwards, but in the way in which as the throat of a sheep is cut when slaughtered by a butcher. The point of the knife had been passed in deeply under and below the ear, and it had then been brought out by a semicircular sweep in front, all the great vessels of the neck, with the gullet and windpipe, having been divided from behind forwards. The nature of this wound further served to detect the murderer, a butcher, who was subsequently convicted and executed.

In *R. v. Cogan* a man was charged with the murder of his wife by cutting her throat. The wound was eight inches long. It began near the centre of the back of the neck on the right side, passed downwards and forwards on this side of the neck across the throat to the middle of the left collar-bone. It was a very deep wound; it divided the windpipe, all the principal arteries of the neck, as well as the muscles, and even extended to the cervical vertebræ. The deceased probably did not move after being attacked. A bloody razor was found six feet from the body, and there was a pool of blood near this spot, while there were marks on the window-shutter produced by the spurting of blood from arteries. There were fresh cuts upon the left hand of the deceased, such as would be caused by her grasping some sharp instrument. The prisoner was convicted.

The medical witness would not say it was impossible, but he thought it highly improbable that the wound could have been self-inflicted. The prisoner had a slight wound in his throat, and he stated that this had been caused by his wife, who had afterwards killed herself. No blood had been effused at the spot where he said this wound had been inflicted. Such a wound as this could have been produced, if at all, only by the left hand of the deceased; its situation, direction, and extent, were more consistent with homicide than suicide, and the latter appears to have been clearly negatived by the facts—(1) that the deceased had bled in two places, while death must have been almost instantaneous; (2) that the weapon was found at a distance from the body; and (3) that the left hand of deceased was much cut, which could be explained only by the theory that she had endeavoured to protect her throat when attacked.

In the museum of the Sussex County Hospital at Brighton is a "detached portion of a windpipe consisting of parts of the cricoid, thyroid and arytenoid cartilages, with complete circumference of the tube." This was cut out of a woman's throat by an undoubted act of suicide. Dr. Humphry found the victim "on her back dead with a razor and the piece of trachea by her side." The evidence at this inquest proved conclusively that it was suicide.

When persons suffering from insanity commit suicide, they often inflict upon themselves wounds of an extraordinary kind, such as would, at first view, lead to a suspicion that the wounds had been inflicted homicidally.

The principles generally used to distinguish homicidal from suicidal wounds must be applied guardedly in the cases of insane persons.

A woman suffering from delirium tremens tore open her abdomen with her hands. The wound produced was eight inches long, and about eight feet of the small intestines protruded from it as well as a portion of the large intestines, which had been completely torn across. She lived 27 hours after inflicting this injury. A pregnant woman under a delusion ripped open her abdomen so that a large wound was made, and the omentum and gravid uterus protruded. A gentleman was found lying in a state of insensibility in the kitchen of his house, with a cleaver by his side. On examining the head upwards of 30 wounds were found over the back part of the skull. The wounds, many of which were superficial, had a horizontal direction from behind forwards. One, however, had removed a portion of the skull from the middle of the lambdoidal suture, so that some of the brain had escaped. This insane person died four days afterwards, but recovered so far as to admit that he had inflicted the wounds on himself. From other circumstances, there could have been no real doubt as to this.

Incised wounds in the throat are generally set down as presumptive of suicide; but a murderer sometimes wounds this part with a view to concealing his crime. Circumstances connected with the form and direction of a wound may in such cases lead to detection; for, unless the person attacked be asleep or intoxicated, resistance may be offered, evidence of which may be obtained by the presence of great irregularity in the wound or the marks of other wounds on the hands and on the person of the deceased. In some instances, however, it is extremely difficult to state positively whether the wound is homicidal or suicidal. Attacking a person who is asleep, intoxicated, or from age or infirmity incapable of offering resistance, may easily produce a regular and clean incision of the throat.

A woman of 66 whose daughter of 38 was in need of constant care as a mental defective decided she could not risk leaving her to fend for herself in the event of old age or death. She cut her daughter's throat as she lay in bed asleep—by a single seven inch straight wound through the mid trachea and left internal common jugular and carotid vessels. She then cut her own throat at thyro-hyoid membrane level by a series of five elliptical wounds inclined towards the floor of the mouth and marked by some 14 tentative cuts at the left end of the major incisions—a typical self-inflicted cut throat.

The depth to which a suicide can cut his own throat is often a matter of wonder; but there are limits to it, and careful reasoning may distinguish the occasional homicide from the more common suicide:—

herself. Their situation, nature, extent, and direction make them plainly homicidal. The hacking of the bones of the spinal column in *two distinct places* with such force as to cut off part of the bone, after both carotid arteries and jugular veins had been cut through, might be sufficient to justify this opinion, and the classical "protective" wounds of the hands place the matter beyond all doubt.

Kerr[1] reports a case of suicidal cut throat in which the left transverse process of the fifth cervical vertebra had been cut through, and was found lying free in the incised tissues, and suicidal "nicking" of the prevertebral ligaments is by no means uncommon.

In *R. v. Deakin*,[2] the medical evidence was so important, and the judge's criticisms so interesting, that, though much dated, they are quoted in full. *The defence was of suicide, but the prisoner was convicted of murder.*

Dr. W. Horton Smith said he was called to the scene of the tragedy on 26th January, and found the body of the deceased. The left arm lay across the chest, the hand holding a large knife loosely. There was a wound in the neck reaching almost from ear to ear, six inches in length, and the result of two incisions. One incision had first been made on the left side, and the knife had been introduced into the wound again, almost to the bottom of the first incision, and another incision had then been made, passing almost directly upwards to the back of the mouth. The wound was evidently made from left to right. There were indications of other attempts on the throat. On the thumb of the left hand there was a slight wound, a very deep wound between the thumb and the first finger. There were other cuts *on the left and right hands.* *The throat wounds could not have been self-inflicted.* If they had been, he would have expected to find the knife firmly gripped in the right hand, and the wounds transverse, and not tending upwards.

Cross-examined: He did not remember saying at the inquest that it was conceivable the wounds might have been self-inflicted. When confronted with his *written evidence, the witness admitted his signature, but he could not remember* making that statement. It was a fact that suicidal wounds varied more than any others. Whichever of the throat wounds was first inflicted, unconsciousness would have supervened, and it would have been impossible to inflict a second.

Dr. Marsh deposed to making a *post-mortem* examination of the body. *The wounds on the throat had been made by two distinct incisions. The first divided* all the structures down to the bone, and cut a groove in the bone. The second went in a higher direction, and divided the deep structures up to the root of the tongue. The reason why he said there had been two incisions was that the main artery on the left side had been divided twice. The first incision, which was the lowest, cut the main artery across: the second incision, which was higher, also cut the artery across.

His Lordship: We all agree there were two incisions. The point is, why do you speak of one incision as being prior in time to the other? How do you ascertain which incision was the earlier?—Witness: The first incision, which is the lower of the two, cut through the skin and the windpipe and the gullet. Having been cut through, they would retract, be drawn downwards and upwards, so that these structures were not divided by the second incision. The second incision missed them. There was nothing divided twice but the artery. *The division of the windpipe being in a line with the lowest of the two incisions, and with the groove* in the bone, it necessarily follows that the other incision must have been second to it, otherwise the windpipe must have been divided higher. It is impossible for the wounds in the neck to have been self-inflicted.

Cross-examined by Mr. Trevor Lloyd: When before the coroner, did you say, "I think it exceedingly improbable that both wounds could have been self-inflicted; I cannot say that they have not been self-inflicted"?—Witness: Yes, but that is not quite the same thing.

You did not say it was impossible?—I said it was exceedingly improbable.

But you said, "I cannot say they have not been self-inflicted"?—No, I can only say it is improbable.

[1] Kerr, D. J. A., 1924, *Brit. med. J.,* 2. 1042.
[2] Chester Assizes, June, 1894.

His Lordship: But to-day you said "impossible," and you understand "impossible" and "improbable" are not quite the same thing. Is "improbable" right and "impossible" wrong, or *vice versâ*? —Impossible, considering the two wounds.

Why did you say "improbable" only before the coroner?—We were mixed up between one and two wounds. The fact was not clearly brought forward that there were two wounds.

Then with regard to one wound, you would say it is improbable, but possible, that one wound was self-inflicted?—Yes, but I said both wounds to-day.

By Mr. Lloyd: I admit the first wound might have been self-inflicted.

Frank Thomas Paul was examined at some length. The throat wounds, he declared, were certainly not self-inflicted. Either of them would have been rapidly fatal. Many of the deep tissues were divided into two parts. That was quite sufficient to decide that the wounds were made in two cuts. In the witness's opinion, neither of the wounds was self-inflicted. Speaking of the lower cut by itself, if that had been the only one his reasons for saying that such a cut was homicidal rather than suicidal were —(1) the size of the wound, and (2) that the deep tissues were cut further than the skin. These reasons were applicable only to the hypothesis of only one cut on the neck, and without regard to the other wounds on the hands, etc.

His Lordship: How a wound on the hands can affect the view regarding a wound on the neck passes my comprehension.—Witness: All authorities on medical jurisprudence consider them of the utmost importance. We cannot judge a single cut by itself. Medical men, any more than courts, don't come to a conclusion on one point alone. Here is a wound which might have been either homicidal or suicidal if you take one alone.

His Lordship: Really I must ask you to bear in mind you have nothing to do with the issue of this case. You come here to give scientific evidence, and if a hypothesis is placed before you, you must answer on that hypothesis.—Witness: I was trying to answer in such a way as not to mislead you.

Examination continued: Witness said it was, in his opinion, impossible for a suicide to inflict the second wound, which was an upper cut, because the second wound commenced in the first cut. The effect of the first cut upon the victim would render her almost immediately unconscious. The wound was so deep upwards as to be almost unknown in cases of suicide. Witness never heard of a wound being in an upward direction in throat wounds of this kind. The throat wounds were unquestionably from left to right. Such a wound, if suicidal, must be cut with the right hand. The other small cuts and scorings on the neck were quite different from the tentative wounds caused by a suicide in making up his mind to cut his throat. They rather resembled the wounds made when the assailed was trying to escape the assailant's knife. The cuts on the hands showed several attempts to grasp the blade of the knife.

Cross-examined: Suicidal wounds varied more than any other in direction and extent. It was not a fact that a maniac would often cut upwards, but it was stated in some books that maniacs might cut upwards. It was always regarded as a sign of homicide when the wounds were upwards. A maniac would cut in almost any direction. It was a fact that a suicide sometimes dropped his weapon; he either gripped or dropped it.

We have here dealt with at some length with incised wounds, but reason dictates that similar principles –as to what *is* and what *is not* possible of self-inflictions apply to all classes of wound and injury.

We should always search the whole of the body carefully for evidence of violence. The insides of the arms or thighs may present marks of injury which could not possibly be explained on the supposition of accidental fall. Multiple severe contusions on both sides of the body, or anteriorly and posteriorly, commonly indicate homicidal violence.

The body of a woman alleged to have been murdered by her husband presented numerous marks of contusions, and one arm was deeply bruised from the shoulder to the hand. The person charged with the murder ascribed these appearances to the fact of his wife having accidently fallen out of bed; but on examining the bed it was found to be only a foot from the floor. A fall from this height would not account

for the presence of such extensive marks of violence; but, irrespective of this, a severe contusion was found on the outer side of the opposite thigh, which, from the appearance, must have been produced about the same time as that on the arm. The existence of this second contusion rendered the defence still less probable; for the woman could not, if she had fallen at all, have fallen on both sides of her body at once, and it was not alleged that she had more than one fall.

Medical evidence regarding the nature, probable origin, and date of any wounds found on a child who may be unwilling or unable to give evidence may be of the utmost importance in deciding the question "Accident or Intent?"

In *R. v. Cattermole* (C.C.C., 1940) a child of five months reported as 'found dead in its cot' by the mother, was noticed to have several minor bruises on each cheek by the doctor who was called in, and these raised his suspicions. He reported the death to the Coroner. *No other external mark of injury was present*, but autopsy revealed severe chest and abdominal injuries, with 15 fractured ribs and pulped liver. *The injuries suggested that the child had been picked up by the head and dashed against some piece of furniture—as the mother later admitted.*

(d) Evidence from the Direction of a Wound. The direction of a wound may be of value in investigating a case. In most suicidal wounds inflicted upon the throat the direction of the cut is from left to right, either transversely or more often passing elliptically, in suicidal stabs and punctured wounds, the direction is commonly from right to left, and from above downwards. In left-handed persons the direction would, of course, be the opposite. Suicidal wounds are, however, subject to much variation in extent and direction, and it is unwise to lay down invariable principles with respect to them. Nevertheless, an attention to these matters *is always of real assistance*, especially when the body has not been moved from the position in which it was found. If a murderer makes an incised wound in the front of the throat from behind, the direction may be the same as that commonly observed in cases of suicide. Again, if the person attacked is powerless, the wound may be *deliberately made so as to resemble a suicidal act*. A homicidal stab may also take the same direction as one which is suicidal. for the positions of an assailant and a victim may vary enormously. The direction of a wound delivered by an assailant facing the victim is probably from right to left; but in suicides, where the right hand is used, it is the reverse. Oblique wounds *passing from above downwards are common to homicide and those which take an oblique course from below upwards are also strongly indicative of homicide*, for it is uncommonly that a person bent on suicide thus uses a weapon.

A youth of 17, due at his engagement party, failed to make an appearance, and search discovered him face down on his bed in a locked room, a knife under the chest. There were two stab wounds in the epigastrium, both directed upwards into the heart: the boy had left a letter indicating his intention to commit suicide and no question of foul play could be considered.

Homicidal incisions, especially in the throat, are often prolonged beneath the skin forming the ends of a wound (undercut is the common term) deep into the soft parts. Those which are suicidal rarely possess this nature, but exceptions to these features may, of course exist.

The instrument with which a wound is supposed to have been inflicted should be related to the shape of the incision, its sharpness compared with the cleanness and evenness of the cut, and its length with the depth of the incision or stab. The *end* of an incised wound in the throat is often digitated, owing to the skin being dragged forwards in folds by the cutting instrument;

and, when recent, the minute saw-like serrations of the skin point towards the commencement of the wound.

If, by examining the ends of a wound, it becomes possible to decide whether it was inflicted from right to left, or *vice versâ*, it is then sometimes possible to say which hand was used by a suicide, or, if the relative position of the parties is known, by a murderer, a point which may have an important bearing, if either of them be known to be only right- or left-handed. It is necessary, however, for a medical jurist to be aware that there are many persons who are ambidextrous, i.e., who have equal facility in the use of the right and of the left hand. This may not be generally known to the friends of the deceased; and such persons are often pronounced, even by those who had associated with them, to have been right-handed. A want of attention to this point may lead to a suspicion of murder.

A man was found dead on his bed with his throat cut, the razor being on the left side of the bed, whereas it was generally supposed and asserted that he was a right-handed man. The truth was, he was equally expert in the use of the razor with his left and with his right hand; and thus the suspicious circumstances of the razor being found on his left side was at once explained away.

A case of suicide by cut throat occurred in London which shows the necessity for caution in forming an opinion in these cases. A man, known to be right-handed, was found dead with his throat cut; it proved to be what is called a "left-handed cut," *i.e.*, done with the left hand. It appeared in evidence that deceased was brought up as a woodcarver, a trade which requires a man to use both hands equally well. Thus the reason for the wound being in an unusual direction for a right-handed man was satisfactorily explained.

The direction in which a wound has been made may not infrequently be determined by the serrated character of the edges: the points of these serrations are directed towards the commencement of the wound. In cases of cut throat the existence of small **tentative cuts** near the commencement of the main cut affords aid in judging the direction of the chief wound, and if such tentative cuts are superficial and parallel with the chief wound they are suggestive of suicide. If any more superficial wounds are different in direction from the principal wound, this points rather to homicide than suicide, and may be referred to the attempts by struggling to evade the assassin's knife.

However indecisive the indications may be from the direction of incised wounds, those from the **direction of stabs** give precise information as to the position of the weapon at the time the wound was made, and therefore of the position of the assailant's arm; and still further deductions may often be drawn as to the relative positions of the parties, points which may be of no absolute and positive value in themselves, but are very important in corroboration or contradiction of the story of the accused person.

In *R. v. Crisp* (C.C.C., 1943) a woman, accused of the murder of her husband who had been associating with another woman, said that he had rushed at her and she had picked up the first thing that came to her hands—a long thin bladed knife. The wound was a five and a half inch deep horizontal stab wound between the left sixth and seventh rib cartilage. The pathologist agreed that such a wound could occur if a man rushed at a woman who held such a knife thrust out in front of her—in a defensive gesture. Accused was found not guilty.

When a medical witness has admitted that the wound *may have been* accidentally inflicted he has gone as far as professional knowledge will permit. The question of probability must be solved, if at all, by the other circumstances of the case. Self-inflicted wounds have certain traditional features, but accident is capable of infinite variation.

At Douglas, Isle of Man, a man was put on trial for murdering his wife. Medical evidence proved that the fatal wound had penetrated the left side of the chest close to the sternum in the third intercostal space. Close to the sternum the wound was deep, and had cut the pulmonary artery. Farther away the wound became shallower, ending as a mere skin incision. The prisoner alleged that he was cutting his nails with a sharp penknife (the admitted weapon), and that, as his wife aggravated him, he had pushed her away with his hand containing the knife and brought his hand round in a sweep. The wound precisely corresponded with such an explanation, and led to the acquittal of the prisoner.

In *R. v. Lyons* (C.C.C., 1939) a girl flung a table knife at her sister who was sitting on a couch facing her—taunting her with not having a fiancé. The victim turned her head away, but received the impact behind the left ear. A horizontal wound was caused penetrating under the mastoid, between the first and second cervical vertebræ severing the vertebral artery and penetrating the spinal cord. A third party was present to witness the 'accidental' nature of this fatal wound.

(e) Evidence from a Multiplicity of Wounds. It is obvious that much will here depend upon the nature of the multiple wounds and their situation. For instance, wounds found on the hands in conjunction with a fatal cut in the throat or a stab are strongly presumptive of homicide, the hands being wounded in attempts at defence.

In *R. v. Gardner*, this question was of considerable importance. Sequeira, the surgeon who was called, found the woman dead of throat wounds, and blood was copiously effused, but only on each side of the neck, not in front of her person. A large table-knife, loosely placed in her right hand, was lying in the direction of the length of the body, the back of the blade towards the chest, and the sharp edge in front. There was dry blood upon the blade and handle. The body was lying at full length in a corner by an open door, *the right arm, which held the knife, being partly under a bed.* The wound in the throat cut through the bone and thyroid cartilage of the larynx, dividing the thyroid artery, causing death by inhalation of blood. It commenced over the larynx as by a deep stab, and extended for about two inches downwards and backwards on the left side. It must have been inflicted while the deceased *was lying down, and it was not such a wound, in the opinion of the medical witnesses, as a woman could have inflicted on herself while in this position.*

The palms of the hands and adjacent fingers presented numerous fresh cuts. The sharp blade of the knife had probably been grasped by the deceased in resisting her death. There were four cuts on her left hand and six on the right, and of two on the middle finger of the left hand one had gone completely through to the bone. *The husband was convicted of the crime.*

These injuries arise from an instinctive effort to protect the throat under a sudden attack. They are readily distinguished by their situation on the "grasping surfaces" of the hands, from the cleaner cuts, usually across the fronts of the wrists, inflicted by suicides. Their presence should admit of some reasonable explanation. In *R. v. Gardner* this was one of those facts properly considered to be inconsistent with the innocence of the prisoner. Their absence implies an inability to resist:

In *R. v. Donoghue* (C.C.C., 1951) the victim had been found dead in the passage outside a fourth floor apartment at Waterloo. There were 17 deep stab wounds over the left side of the head, face and neck, four of the latter penetrated the jugular or carotid vessels and entered the pharynx which was filled with blood. There were no protective injuries to the wrists or hands and no weapon was found near the body. Accused, with whom the victim had been drinking, admitted the stabbing but said he was so befuddled that he had taken the man to be a dummy when he had found him on his bed and had thought his friends were playing a practical joke on him. The dead man's blood alcohol was 310 mg. per cent which might be expected to have rendered him incapable of any defence. The court accepted the defence and the jury convicted Donoghue of manslaughter, no doubt on evidence other than medical.[1]

The presence of several wounds on different parts of the body or the marks of several attempts around the principal wound have been considered to furnish presumptive evidence of murder. But any inferences of this kind must be cautiously drawn, since not only may a murderer destroy his victim by one wound, but a suicide may inflict many, or leave the marks of several attempts before he succeeds in his purpose. The retention of consciousness and of volition forms an important factor in assessing the nature of multiple wounds.[1]

In wounds of the throat, owing either to ignorance of the situation of vital parts or to tremulousness of the hand, a suicide often produces one or more incisions of greater or less extent near that which has destroyed life. This is especially the case when the instrument happens to lodge in the first instance on the cartilages of the larynx. The same remark applies to suicidal stabs when the point of a weapon, in being directed against the chest, comes first in contact with the ribs or their cartilages. With respect to the throat, many cases might be cited in which even six or more deep incisions have been made in this part by suicides before they have succeeded in destroying themselves. Reference has already been made to the significance of additional tentative scratches.

A medical man killed himself by inflicting several wounds on his throat. An incision was found on each side of the neck, just below the angle of the jaw, and in the hollow behind it. The wounds were irregular in form, and bore the nature of deep stabs. The only important vessel divided was the internal jugular vein on the right side; but nevertheless a large quantity of blood was lost, and this was no doubt the cause of death.

The case is singular in many points of view, for such wounds quite lack the features of suicide. It would appear that the deceased was ambidextrous, and that the wound on each side of the neck was inflicted by the hand of the opposite side.

The *number* and *nature* of the wounds may lead to a strong suspicion of murder: when these features are unusual or perplexing, the absence of "protective wounds" may in certain circumstances become a factor of importance.

about the size of a shilling lay almost detached in the wound. There were no marks of violence on the hands or on any other part of the body.

The circumstantial evidence at the inquest supported a theory of suicide. She had spoken to the neighbours and her husband in a desponding manner a few days before the event. The husband and wife had lived on good terms, and no motive for his perpetrating such an act could be suggested. A verdict of "Wilful murder against some person unknown" was nevertheless returned. These wounds might have been inflicted by the deceased on herself with her left hand, probably in an attempt to cut off her head.

On the contrary the number of *vital* wounds sustained may alone be sufficient to preclude the possibility of self infliction.[1]

In *R. v. Vassiere* (C.C.C., 1936) a woman was found dead by the side of her bed with 67 wounds on her body, covered by a bloodstained coverlet. 43 were stabbed or slashed sharp wounds as from a knife, four were heavier blunt wounds to the head as from an axe or a hammer, and the remainder (20 wounds) were abrasions, small finger-type bruises and scratches, many about the neck and shoulders.

In *R. v. Hamerton* (C.C.C., 1940) a Camberwell waitress had been found dead in the scullery of her home, a carving knife thrust to the hilt in her left breast, through the heart. 16 other stab wounds were present, 11 of them in the chest—of which six had entered the back, between the shoulder blades. Protective wounds were present in the right upper arm (which had been transfixed by a knife), the left forearm and to the right hand (between the palm and fingers) and wrist. A savage assault by her fiancé, a butcher's assistant, had been warded off to some extent before she succumbed.

In acts of murder perpetrated by insane persons it is usual to find even larger numbers of wounds on the body of the person attacked, and the same may be true of suicide in the insane, the differences being the character of the wounds:

In a case at York, a man in a fit of delirium tremens killed his wife by cutting and stabbing her. There were 56 wounds, of which some were plainly inconsistent with self-infliction.

Kerr[2] has described a case of suicide in which he counted 440 separate incised wounds over the front of the body, fully a half consisting merely of superficial skin cuts over the chest front and abdomen.

In examining an injured or wounded body, attention should be paid to the mouth and throat. Assailants sometimes endeavour to close the mouth, or to compress the throat, so as to prevent an alarm from being given. In the case of the Duchess de Praslin, there were marks of fingernails around the mouth. Ecchymosed impressions, as if produced by a hand, are found upon the throat of the victims in some cases of blunt injury to the head—as if to steady the head or pin it in order to hit it squarely.

Two or more Mortal Wounds. It has been asserted by some medical jurists that when two mortal wounds are found upon a body, and particularly if one of them is of a stunning or stupefying nature (i.e., affecting the head), they must be considered inconsistent with suicide. An inference of this kind can be applied to those cases only in which the two wounds, existing on different parts of the body, were likely to prove *immediately* fatal. It must, however, be borne in mind that all *suicides* do not *immediately* perish from wounds which are extensive and ultimately prove fatal; on the contrary, they have often the power to perform acts of volition and locomotion which might seem wholly incompatible with their condition. It is difficult to say whether one wound was likely to cause death so rapidly as to render it

[1] Simpson, K., 1951. *Police J.*, 27, 110.
[2] Kerr, D. J. A., 1954. *Forensic Medicine*, 5th Ed. London. Adam & Charles Black.

impossible for the person to have inflicted another wound upon himself; but when there are several distinct incisions or stabs on the throat, each involving important blood-vessels, there is a strong suggestion that they were criminally inflicted. There are no rules by which the instantaneous mortality of wounds can be accurately determined—a fact which is apparent by experience of wounds of the head, heart and throat.

Nor is it possible to say, from the mere extent of marks of contusion or injury on the head, that the deceased must have necessarily suffered from insensibilty or concussion, and have therefore been afterwards unable to inflict any wound upon himself. Injuries of the head are accompanied by singular anomalies in this respect. One person will be rendered insensible and powerless by a blow which may leave scarcely any appreciable marks; whereas another will be able to walk and exert himself after the skull has been fractured and depressed, blood effused, and even when a portion of brain has been lost. The appearances may be such as to induce an incautious opinion that death must have taken place instantaneously. A medical witness should be fully prepared for the occurence of such anomalous cases; but a strong suspicion of homicide may fairly arise when, in addition to marks of grave injury to the head, a severe cut or stab is found on the body. A man is not likely to cut or stab himself after having sustained severe violence to the head; but he may retain the power of precipitating himself from an elevated spot, and thereby of producing great injury to the head, after having previously attempted to cut his throat or stab himself.

A man was found lying dead in the street in the low quarter of London with his skull severely fractured and his throat cut. The evidence adduced at the inquest showed that the deceased had attempted suicide by cutting his throat in his bedroom, and had then thrown himself out of the window, by which the fracture and other severe contusions had been produced.

The circumstantial evidence and the nature of the throat wounds are all-important to the proper assessment of such a case. A similar observation may be made in regard to the following cases:—

A prisoner in a London jail was found hanging by his tie to the window bars. Only at autopsy was it discovered that he had a mailbag needle thrust into the heart through the front of the chest: it still lay in situ, the 'eye' end just visible in a small skin puncture, the three and a half inch shaft buried obliquely into the wall of the left ventricle. There had been a barely measurable loss of blood—a solitary dry drop at the entrance wound.

In *R. v. Corder*, a woman was found dead nearly twelve months after she was first missed. A handkerchief was drawn tightly around her neck, and a bullet wound was traced through the left side of her head, passing out at the right orbit; three other wounds were found, one of which had entered the heart, and all of which had been made with a sharp instrument. The prisoner charged with the crime alleged that the deceased had committed suicide; but the variety of the means and the instruments employed to cause death, as well as the fact that the bullet wound in the head, the stab in the heart, and the act of strangulation were individually sufficient to account for speedy disablement, if not death, left no doubt that this was an act of murder.

vertebra, about two-thirds of the intervertebral substance between these bones having been divided. A portion of the second vertebra had been cut through, and was *left adjacent to the lower lip of the wound*. The left vertebral artery was also completely divided. The lower lip of the wound was serrated, and the neck was slightly wounded lower down on the same side, showing that several strokes had been made in this part with the weapon. In the *left* hand of deceased a common dinner knife was found, loosely *held*: it was in a reversed position, with the back instead of the edge towards the throat. The left hand presented three incised wounds over the middle finger, one of considerable depth, and another reaching to the bone over the outer side of the ring finger. The right hand had only one slight wound upon it. The deceased was *right-handed*.

Wounds of this kind were quite inconsistent with suicide. A suicide could have inflicted a wound in this situation and direction only with the right hand, but the weapon was lying loosely in the *left* hand of the deceased. There were deep recent cuts on the back of the left hand showing that the deceased had raised it to protect her throat. A fellow-servant of the deceased, although not at first suspected, was tried, and convicted of this act of murder upon his own confession. His clothes were examined, and it is worthy of observation that, *with the exception of a few small spots on the shirt, they were free from any marks of blood*. The knife found in the hand of the deceased was bent towards the end as if it had been used against some hard obstacle. It had been wiped; but it still contained in its depressions and irregularities, as well as between the layers of the handle, coagula of recent blood mixed with rust. In a small coagulum found on the knife, dried and fixed to the blade, were some woollen fibres of a peculiar purple-brown colour. These corresponded exactly to the fibres of the woollen jacket which the prisoner wore. This observation was of great importance in connecting the accused with the crime. This case affords an excellent example of the immense weight of guilt which can be laid upon a suspect when circumstantial and medical evidence are carefully collated and presented in orderly arrangement. No jury could fail to be convinced by such argument.

When several wounds are found on a dead body, the question is frequently asked, Which was first received? If one is likely to fell, disable or kill, and the others not, it is probable that the latter were inflicted first. This remark applies both to cases of homicide and suicide; but of course when, in a murderous assault, a person has been rendered unconscious by a blunt head injury likely to become fatal, other equally lethal injuries may follow. Moreover, if a victim has been set upon by several assailants at once, numerous grave and superficial wounds may have been simultaneously produced. This is, however, a question to which it is not easy to give a specific answer. Each case must be decided from the special circumstances attending it; and in most instances, unless some direct evidence is forthcoming, a medical opinion can be little more than conjectural. This question is almost always put in a court of law, and a witness should at least prepare himself to meet it by placing the wounds in an order which satisfies the medical conditions. A reconstruction of the crime under these conditions may be extremely helpful to the investigating authority and may also be helpful in court, as in the following cases:

In *R. v. Gribble* (Leicester Assizes, 1944) the maggot ridden remains of a youth had been found in a spinney at Kempston, Beds. Reconstruction of the skull showed it to have sustained at least four blunt injuries, three to the face and one across the back of the vault of the skull behind the left ear.

The injuries were set (1) across the left eye, sweeping past the eyebrow and crushing the bridge of the nose, (2) to the mouth, breaking off the crowns of several teeth and dislodging others, (3) to the left lower jaw, fracturing it; the right mandible neck (under the joint) was fractured showing this blow to have been directed obliquely, like a 'knock-out' blow; finally (4) at least one crushing blow had fractured and depressed the skull vault behind the left ear, and a counter crushing of the right molar (cheek) prominence suggested the face had been on the ground at the time.

¹ Simpson, Keith, 1946. *Police J.*, 19, 180.

Deceased, it was suggested therefore, had been struck with a heavy bludgeon, (1) across the left eye (probably collecting eyebrow hairs), (2) in the mouth dislodging teeth and causing bleeding—but still not felling the victim, (3) a knock-out blow to the lower jaw, felling him and (4) *a mortal wound on the back of the head inflicted after the victim was felled and incapable of resistance*. This last inference made any thought of reducing the charge to one of manslaughter impossible: several days later a 3 lb. 2 oz. bough, heavily bloodstained, was found nearby with one head hair and six eyebrow hairs indentical with samples from the victim attached.

Gribble, a boy of 16, suspect of the killing, made four successive statements commencing by saying 'I never saw Bob (deceased) on the Sunday afternoon', then volunteering details of a fight which did not fit the medical findings described above, finally admitting 'I first struck him on the side of the face. He hit me in the stomach and I hit him again with the piece of tree on the head. He was bleeding but continued to fight, so I hit him twice more with the piece of wood on his head. He fell down then and whilst he was lying on the ground I hit him twice on the head with the same piece of wood. I realized I had knocked him unconscious'.

Not one but two wounds inflicted on a helpless felled victim (almost certainly knocked out by the jaw wound) was enough to substantiate the charge of murder. This reconstruction of the order and nature—and probable effects—of these successive blunt injuries was vital to the police in pressing accused on the fallacies of his earlier statements, and to their charge of murder. Conviction followed.

A man found dead in his kitchen bore one cleft wound on the top of the head, heavy bruises over the back of the scalp and a series of seven parallel cleft or chopped wounds set close together on the left temple. There were no protective injuries. It was suggested, therefore, that he was first struck a disabling blow, as from a chopper, on the top of the head, causing him to fall on to his back—where, whilst unconscious from the first wound, he was struck seven more wounds in quick succession. The absence of protective hand or forearm injuries required explanation: he was not asleep, for this happened in the middle of the kitchen, analysis showed he was not drunk, and the alternative was 'surprise': he could have been caught with the head down, entering the room where, it turned out, his son lay in wait for him, chopper in hand. The boy shot himself with a ·410 shotgun, dying before he could be arrested for the crime.

Evidence from Foreign Bodies in the Wound

Foreign substances are sometimes discovered in contused or lacerated wounds, and these may throw an important light on the circumstances in which a crime has been perpetrated.

In *R. v. Hazell* the body of the deceased was found in a well. When examined, there were on the head several wounds sufficient to account for death. There was much blood on the clothes and face, and in the blood were sticking a quantity of hay-seeds, which led to the conclusion that the wounds must have been inflicted in a stable, or in some place where there was hay. On examining a neighbouring stable the spot where the murder was committed was made clear by the discovery of bloodstains.

There may be found in the wound a portion of the weapon itself. The preservation of this is necessary, as it may serve to connect an accused person with the crime.

In *R. v. De Salvi* the deceased died from a stab inflicted on him by the prisoner. Two inches of the pointed portion of the blade of a knife were found imbedded in one of the vertebræ. The spinal cord had been divided, and paralysis, ending fatally, was a result of the wound. The identity of the weapon was not only established, but the force by which it had been used by the prisoner was thus clearly indicated.

Q brandy bottle
R lower denture
S fresh wool
T upper denture
U blood stained cotton
V cigarette end
W single black hair
X matted white hairs
Y lotion bottle
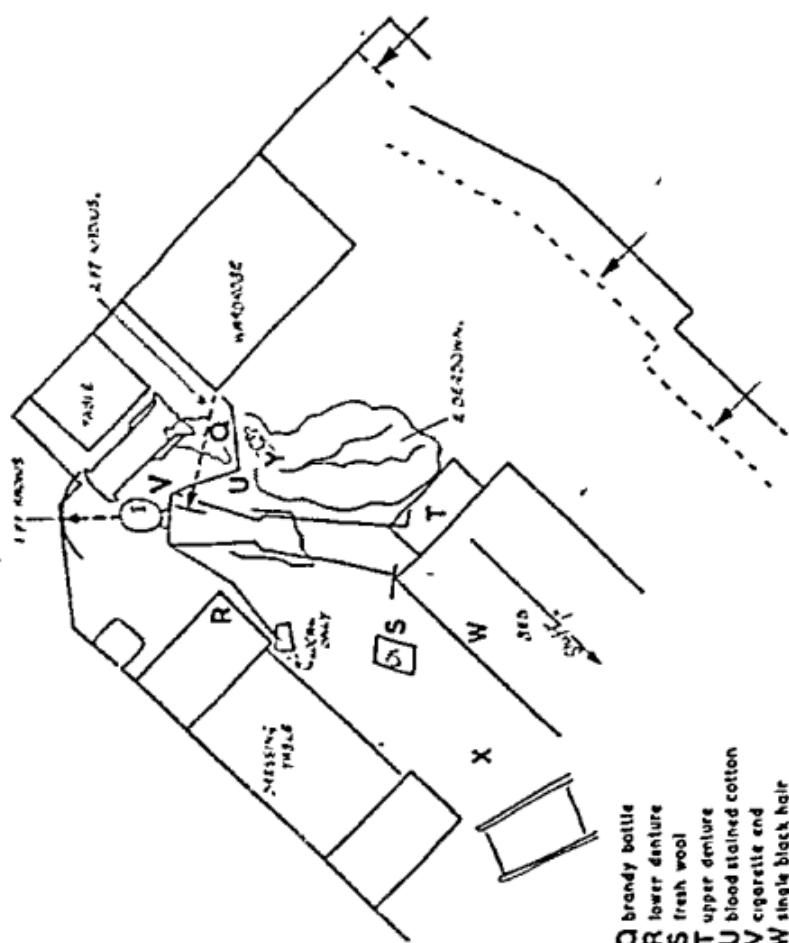
Fig. 244.   Approximate scale drawing made at scene of crime by pathologist to assist him in the reconstruction of events and the relationship of furniture and dissected articles to the medical items referred to. Note the devices used

Fig. 235b.

for marking the positions of articles, level of clothing over the legs, inclination of head and position of hand on glass, distance of head from wall, etc., and of trunk from nearby furniture. An adjustment of the wall to scale was made as shown. (See also photograph Fig. 235b).

razors were found. The blade of one of these, stained with blood from end to end, had been partly wiped. The edge of this razor presented several notches, corresponding to the portions of steel found on the vertebra. The handle of the razor was also partly unrivetted, suggesting that it had been used with very great force. Not only was suicide thus disproved, but the murder was fixed upon the accused.

Evidence from the Surroundings

With regard to the homicidal or suicidal nature of wounds, attention may be called to the weight of the evidence derived from the circumstances in which the body of a person is discovered.

It would certainly be wrong to base a professional opinion exclusively on the facts so ascertained, but it is scarcely possible for him to avoid drawing an inference from them. The medical evidence may be weak and insufficient to support the charge against the accused; in such a case, if any suspicious circumstances have come to his knowledge, he may be often unconsciously induced to attach greater importance to the medical facts than he is justified in doing. But if a proper degree of caution is exercised in drawing inferences, and the circumstances are not allowed to create a prejudice in his mind against the accused, a doctor is bound to observe and to record them; for, being usually the first person called to the deceased, many facts capable of throwing an important light on the case might remain unnoticed or unknown but for his attention to them.

Among the questions which present themselves on these occasions are the following: Is the position of a wounded body that which a suicide could have assumed? Is the distance of a weapon from the body such as to render it improbable that it could have been placed there by the deceased? In answering either of these questions, it is necessary to take into consideration the extent of the wound, and the time at which it probably proved fatal. Again, it may be inquired, has the deceased bled in more places than one? Are the streams of blood all connected? Are there any marks of blood on his person or clothes, which he could not well have produced himself? Are there any projecting nails or other articles which might account for wounds on the body as the result of accident? These are questions, the answers to which may materially affect the case; hence a doctor, in noticing and recording the circumstances ought to exercise the utmost caution.

The rules respecting the admissibility of this kind of evidence are those which apply to all factual evidence: *it may be oral or documentary. A doctor would do well to make notes or a plan at the time, for he is allowed to "refresh" his memory by reference to these.*

Medical facts, when properly observed and interpreted, are often of the highest importance. In order to convict an accused person on circumstantial evidence, the facts proved in the case should be consistent with his guilt, and be utterly inconsistent with his innocence. In the language of a judge, a certain number of material facts should be incontestably proved in the case which are quite inconsistent with the innocence of the accused. These facts should be such as to render it impossible in the minds of the jury that anyone but the accused could have committed the crime. Alderson, B., in charging a jury to this effect, made an observation in reference to circumstantial evidence which should be remembered by medical witnesses. He emphasized the "proneness of the human mind to distort the facts in order to establish such a proposition" (the guilt of the accused), "forgetting that *a single circumstance which is inconsistent with such a conclusion is of more*

importance than all the rest, inasmuch as it at once destroys the hypothesis of guilt".

In the Thorne case (Lewes Assizes, 1926) it was suggested, for the defence, that Elsie Cameron, whose body had been found buried on Thorne's chicken farm at Crowborough, had hanged herself from the cross beam of his hut in his absence. Considerable argument ensued at trial between no less than eight doctors on the nature of marks on the neck and of bruises of the face—but the plain fact was that the beam in question was found to be *thick with dust on its upper surface:* no rope had lain over it in recent years.

Position of the Body and Clothes. The body may be found in a position which the deceased could not have assumed on the supposition that the wound or injury was accidental or suicidal. The position of a dead wounded body is often only compatible with homicidal interference, either at the time of death or afterwards.

The position of the body when a wound was inflicted is a frequent question on inquests and criminal trials.

In a case of fratricide, the deceased had received a severe wound at the lower part of the neck, and another in the front of the chest, which had led to his death. As the blood had run down the front of the body from both of the wounds, and one of them was so deep that the deceased, unless supported, would probably have immediately fallen, it was inferred that two persons had been engaged in the murder, and that one held the deceased by the arms while the other struck him in front. This suspicion was corroborated by there being no marks of wounds upon the hands. The opinion thus expressed was confirmed by the evidence given at the trial of the murderer.

If the deceased has been wounded with his clothes on, we should notice whether any part of his clothing has or has not been cut or injured over the situation of the wound, whether the cut portions of clothes are bloody, and whether the blood has been effused or applied on the *inside* or *outside*. When, together with a wound in the throat, we find the tie and the shirt cut through, this, all other circumstances being equal, is strongly presumptive of homicide. Suicides seldom allow any mechanical obstacles of this kind to remain as an obstruction to the use of the weapon. However, in one case of homicidal wound of the throat, inflicted in the recumbent posture, the tie of the deceased had been lifted up, and afterwards allowed to drop over the wound, in order to conceal it. The importance of examining the clothing and comparing it with marks of violence on the body has already been pointed out.

Marks of Blood or other Substances on the Deceased and in the Room. All marks or stains of blood or dirt on a dead body require special attentions. The impression of a hand, or of some of the fingers, may be found on the skin in a situation where it would have been improbable or impossible for the deceased to have produced it, even supposing that one or both of his hands were covered with blood.

In *R. v. Garlner*, Sequeira found an impression made by sooty fingers on the inside of the left wrist and a similar sooty impression on the left elbow, as if it had been forcibly grasped. On the inside of the right thigh there was the impression of the palm of a bloody hand of full size, pointing downwards. He noticed these marks before the prisoner, who was a chimney-sweep, had entered the room; and he also observed that there was no soot on the hands of the deceased, and no blood sufficient to produce such an impression of blood as that existing on the right thigh. The impression was also larger than the hand of the deceased.

In a strangling (*R. v. Marshall*, C.C.C., 1946), seen at Victoria Station within an hour of death (which was timed by screaming, gurgling noises and then silence) a

begrimed finger mark—one of several on the neck—showed the details of a finger print. They had faded, owing to the elasticity of the skin, before the photographic unit arrived.

Stains of blood on the hands or clothes of a wounded person or dead body may often furnish important circumstantial evidence

In *R. v. Whiteway* (The Towpath Murders) (C.C.C., 1953) blood was found to have run *down* on to the chest from a stab wound in the cheek of one of the victims showing that the girl had been in an upright position after the injury. She had, in fact, been raped after this disabling wound.

If there are several cuts or stabs on the body involving the clothes, it should be observed whether the edges of one or more of them are stained with blood, as if from the wiping of a weapon, and whether the stain is on the outside or inside of the article of clothing.

In judging from marks of blood on the premises, we must take care that we are not misled by the accidental dispersion of this liquid by persons going in and out or touching the body. Moving the injured body, or undressing it is also a common cause of soiling of the face and hands. The following case, which occurred in France, will show the necessity for extreme caution.

A young man was found dead in his bedroom with three wounds on the front of his neck. The physician who was first called to see the deceased had unknowingly trodden in the blood with which the floor was covered, and had then walked into an adjoining room, passing and repassing several times; he had thus left a number of bloody footprints on the floor. No notice was taken of this at the time; but on the following day, when the examination was resumed, these footprints excited a suspicion that the young man had been murdered.

In the trial of Mrs. McLachlan for the murder of Jessie McPherson, Macleod observed footprints in blood in the bedroom of the deceased, who was found dead from wounds obviously homicidal. There were three imprints of a naked foot, one of them particularly clearly defined, a small, well-formed foot at rest. Before any suspicion was attached to anyone the medical witness expressed an opinion that they were made by a woman's foot with a high instep. At the time of this act of murder there were only three persons in the house: the prisoner, the deceased, and a man aged 87, James Fleming. Macleod observed that there was no blood on the foot of the deceased: further, he made a careful outline of her left foot, and found that it did not in any way correspond to the footprints on the floor of the room. In his opinion the left foot of the deceased could not have produced these marks. He compared the foot of James Fleming with the footprints, and they were obviously quite different; he had a flat foot, in contradistinction to a high sole, by which the marks *had been produced. He also compared the feet of the prisoner with these marks,* especially the left foot, and the marks, in his judgment, might have been produced by her foot. The accused made no objection to tread with her left foot in a thin layer of bullock's blood, and then step on a plank of wood. When all the conditions of the floor were imitated, two impressions were obtained which corresponded with a remarkable degree of accuracy with the marks taken from the house.[1]

Marks of Blood on Furniture. It is proper to notice all marks of blood in the room, and to observe where the greatest quantity of blood has been effused; this is generally found on the spot where the deceased has died. The deceased may have bled in more places than one; if so, it should be noticed whether there is any communication in blood between these different places. Blood on distant clothes or furniture will show whether the deceased has moved or has been moved about, and whether he has struggled much after receiving the wound. Acts of locomotion by a wounded person who has died from loss of blood, or by a criminal whose hands and feet may be bloody, are generally indicated by tracks or marks of blood. The hands and feet of the victim should always be examined, for if they are not blood-stained, the

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[1] Trial of Mrs. McLachlan: "Notable Scottish Trials".

presence of bloody footprints or fingerprints indicates the presence of another person. The observation of these marks is of medical importance; they may throw a light upon the question whether death was homicidal or suicidal.

In *R. v. Hatto* a mark of blood, as from the smear of a hand, was traced along the passage of the house in which the body of the deceased was found. The mark was continued over the doorpost into a back room, which was found locked and bolted on the inside. The crime was thus fixed upon the prisoner, for no one breaking into the house in front could have had access to this room. The evidence thus brought against him was the result of his feeling his way with a bloody hand in the darkness after the murder.

In *R. v. Muller* the outside handle of the carriage door, in which the fatal assault was made, was marked with blood, whereas there was no blood upon the hands of the deceased, which were examined soon after the assault. This was adverse to the theory that the deceased had opened the door and had fallen out.

Great care must be taken to ensure that such stains are looked for *before* the autopsy is commenced: the body becomes inevitably stained during the *post-mortem*, and all such evidence is lost.

R. v. Spicer affords an illustration of the importance in cases where it is suggested that death has been caused by accident, not only of examining minutely the wounds, but also the location of the dead body when found:

The prisoner was charged with the murder of his wife. The deceased was found dead at the foot of a stair, as if she had accidentally fallen backwards. The parietal bone was fractured, and the fracture extended to the base of the skull. The brain was lacerated, and there was copious effusion of blood. The second cervical vertebra was fractured, and the spinal cord crushed. These injuries were quite sufficient to account for death, and had they existed alone there might have been no reason to charge the husband with the murder. But there was a recent wound on each side of the temple, partly lacerated and partly bruised, and a branch of the right temporal artery had been divided, this injury having been inflicted apparently with a pointed blunt instrument. There were marks of blood on the wall at the *top* of the staircase, which had evidently been produced by arterial spurting. It was obvious that the injuries to the two temples could not have occurred during the fall, for there was no projecting body against which she could have struck in her descent. All the facts tended to show that a murderous assault had been made upon her at the top of the stair, and that she had afterwards fallen or had been pitched headlong backwards.

Inference from the Quantity of Blood. When, in spite of open wounds, the amount of blood on the spot where the body is found is small, there is reason to infer that there has been interference with the body after the wound was inflicted. It may have been moved after death from loss of blood elsewhere, but it must also be borne in mind that it may have been stabbed *after* death from some other cause. Where a body with open stabbed or incised wounds becomes immersed in water this basis for argument is, of course, lost.

Evidence Derivable from the Weapon

There are several matters in connection with a weapon which may afford strong evidence.

The Position of the Weapon. Where a person has died from an accidental or self-inflicted wound, likely to cause death either immediately or within a few minutes, the weapon is usually found close to the body or within a short distance of it. If at a short distance, we must consider whether it might have fallen to the spot, or have been thrown or placed there by the deceased.

In November, 1945, a Polish air-officer was found shot dead on Westminster Bridge at about 1.20 a.m. An entrance wound from the close discharge of a firearm

was found over the region of the heart. A ·32 calibre bullet which was found lodged in his spine had passed through the heart. Though the wound was quite consistent with suicide suspicion was aroused because no weapon was found near the body. He could, of course, have thrown the weapon over the bridge after shooting himself. Dragging operations with an electro-magnet were undertaken and a ·32 pistol bearing the Polish officer's issue number was recovered from the river bed.[1]

If there has been any interference with the body, evidence as to the relative positions of it and the weapon will, of course, be inadmissible.

It is compatible with suicide to find the weapon at some distance, or even washed and put away—concealed, but it is much more frequently found either grasped in the hand or lying by the side of the deceased. Exceptional cases do occur, however: in a clear case of suicide the deceased had cut both internal jugular veins and both superior thyroid arteries, the cut having passed to the fourth intervertebral disc, which it injured. He then put the razor in its case and replaced the case in his kit-bag.[2]

There is one circumstance in relation to the position of a weapon which is strongly confirmative of *suicide*. If the instrument is firmly grasped in the hand of the deceased, no better circumstantial evidence of suicide can be offered. It is not possible for any murderer to imitate this condition, since the relaxed hand of a dead person cannot be made to grasp or retain a weapon, like the hand which has firmly held it by powerful muscular contraction at the last moment of life *vide* "Instantaneous Cadaveric Spasm".

In regard to the finding of the weapon at a distance from the body, all the circumstances of the case should be taken into consideration before any opinion is expressed. If the weapon cannot be discovered, or if it is found concealed in a distant place, this is ordinarily presumptive of homicide.

Something may be learned from the actual *nature of the weapon itself taken in conjunction with the circumstantial evidence as to why the particular weapon was used.*

In *R.* v. *Gordon*, (Kingston Assizes, 1944), a knife found discarded in a hedgerow close by where a girl had been stabbed, was of a type issued to Canadian soldiers who at that time were stationed nearby. Enquiry revealed that one of them had a bloodstained handkerchief in his possession: it bore folded-cloth bloodstains (as if used to wipe a knife blade), one of which was shaped exactly like the bent back of the blade of the Army issue knife. It was a weapon every soldier carried in his kit.

It should be noticed also whether the weapon is sharp, single or two edged, straight or bent, and notched or not. These circumstances may throw a light on the question of suicide or murder: the weapon found may not "fit" the wounds.

In *R.* v. *Gill* the prisoner was charged with the murder of his wife. The woman was found dead with a wound in her throat dividing the larynx, the thyroid arteries and gullet. It reached the spine, which was hacked and notched apparently with some violence: several pieces of bone were detached. A blunt knife was lying in the right hand of the deceased loosely, not grasped. The cut through the skin and muscles of the throat was clean, and had evidently been made by a sharp instrument. The knife found in the hand of the deceased was not only blunt, but turned at the point, and it had no handle. There was a mark of a bloody finger on the dress over the left shoulder of deceased.

From these facts Porter and Geoghegan drew the conclusion that the deceased had not inflicted this wound on herself. The wound had not been made with the blunt knife found in the hand, and if this weapon had been used for the purpose of suicide, it would either have been grasped in, or have altogether fallen out of, the hand. The deceased had not made the bloody mark of a finger found upon her dress. The prisoner was nevertheless acquitted.

¹ Fallon, T., 1948. *Police J.,* 21, 110.
² Shore, T. H. G., 1920, *Lancet.* 2, 180.

Blood on Weapons. The weapon with which a wound has been inflicted is not necessarily covered with blood. Heavy blunt instruments applied with force to the head may cause severe injuries without immediate effusion of blood. Unless the bludgeon strikes an injured place a second or third time, and is used in a subsequent struggle, or is handled by a bloody hand, no blood whatever may be found. In stab wounds, the knife may not be bloodstained, or there may only be a light film, which on drying gives to the surface a yellowish colour. The explanation of these facts appears to be that in a rapid blow or plunge the vessels are compressed, so that the bleeding takes place only after the sudden withdrawal, when the pressure is removed. Even if blood should be effused, the weapon, in being withdrawn, is sometimes cleanly wiped against the edges of the wound owing to the elasticity of the skin, or it may be wiped by the clothes as it is withdrawn. Thus the first stab through the clothes may not present any appearance of blood on the outside, but in a second stab with the same weapon the outside of the clothes should present a bloody mark, unless the weapon had previously been wiped. The blood may have been removed by washing from the blade of a knife or dagger. The handle, any crevices, and inside parts should therefore be closely examined.

In *R.* v. *Doidge* the weapon, a large cleaver, had been wiped on the smock of the deceased, but although the blood had been thus in great part removed from the surface of the blade, it had been wiped into the recesses of the letters of the maker's name, which were found to contain coagulated blood.

When a weapon is bloody, particular attention should be given to the manner in which the blood is spread over it. In cases of imputed wounds, or in the attempted concealment of murder, a criminal may besmear with blood a knife or other weapon which has probably not been used, and place it near the body.

A young man alleged that he had received a cut on the forehead by a blow from a cutlass. It was observed by the medical witness that the weapon was smeared with blood on both surfaces, but the layers were thicker towards the handle than at the point. The wound on the forehead was a clean incision; and a cap which the complainant wore, had been cut through. It was obvious, therefore, that the blood on the weapon could not have proceeded from this cut.

The blood on a weapon may be wet or dry, in a partly coagulated state, or spread out as a mere film. If coagulated, this would render it probable that it had issued from the body of a living person or animal, or from a body recently dead.

The Use of Several Weapons. In general, suicides, when foiled in a first attempt, continue to use the same weapon; but sometimes, after having made a severe incision in the throat, they will shoot themselves, or adopt some other method of self-destruction. These cases can only appear complicated to those who are unacquainted with the facts relative to self-murder. Neither the presence of several wounds by the same kind of weapon, nor of different wounds by different weapons, can be considered of itself to furnish any proof of the act having been homicidal. It is their situation and character which indicates whether they are suicidal—or could not reasonably be (*vide* p. 274).

A case is quoted[1] in which a person who killed himself by hanging was found to have inflicted injuries upon himself by a revolver, had tried to cut

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[1] Smith, S., and Fiddes, F. S., 1955. *Forensic Medicine.* 10th Ed. London: Churchill.

his throat, and had attempted to sever the arteries at his wrist before hanging himself.

Hair and other Substances on Weapons. In some instances a few hairs or fibres may be found adhering to a weapon, and the main question may be whether the fibres are of cotton, linen, silk, wool, or other fabric, and whether the hair is that of a human being or of an animal. In one of our cases the driver of a motor car was arrested for causing the death of a child. The child was found dead on the road, and from the marks of the tyres of a car the police traced and arrested a certain driver. Some hair was discovered on the front mudguard of the car and found to be cow's hair.

In numbers of cases we have been able to identify hairs and fibres of different kinds found on both vehicles and weapons as exactly similar to those taken from the clothing or person of a victim. For the means of identifying such fibres and illustrative cases, vide "Identification of Hair" (p. 122).

In *R.* v. *Harrington*,[1] a razor was produced in evidence, with which it was alleged the throat of the deceased had been cut. The edge was examined, and from a coagulum of blood some small fibres were separated, which, under the microscope, turned out to be cotton fibres. It was proved that the assassin, in cutting the throat of the deceased while lying asleep, had cut through one of the strings of her cotton nightcap. This was a strong circumstance to show that the razor produced was the weapon with which the fatal wound had been inflicted.

In *R.* v. *Steed*,[2] Pavy and Taylor examined the boots of the prisoner who was charged with murder. The marks of violence about the head showed that the assailant had trampled on the deceased after he was on the ground, producing severe wounds which led to his death. Some hairs were found firmly wedged beneath the large hobnails of the boots, and in certain dark stains of coagulated blood on the leather there were some red woollen fibres. The hair was compared with a portion cut from the head of the deceased, and corresponded in colour and size. On inquiry it was found that at the time of his death the deceased wore around his neck a red woollen comforter, of which the wool corresponded in colour and appearance with that taken from the prisoner's boots.

Evidence Derivable from an Examination of the Assailant

Marks of Blood or Wounds on the Assailant. It is a common, but erroneous, idea that no person can commit a murder in which blood is effused without having his person and clothes more or less covered with blood. On several occasions articles of clothing have been examined which have been worn by persons subsequently convicted of murder by wounding, and either no blood has been found on any part of the dress or only small spots wholly out of proportion to the quantity of blood which must have flowed from the deceased.

In *R.* v. *Gardner*, in which there had been a large effusion of blood from a severe wound in the throat, no bloodstains were found on the clothing of the man who was convicted of the murder.

The throat of a person while standing, sitting or kneeling may be cut by a *murderer from behind*, and thus simulate suicide. In these circumstances the clothes of the assassin would probably not be stained with blood. The flowing or spurting of blood upon his clothes would depend upon his position in relation to the victim at the time of inflicting the wound, and this must always be a matter of pure speculation. In entire violation of this simple principle, the fact of a prisoner's clothes not being marked with blood has been on more than one occasion urged as proof of his innocence.

[1] Essex Assizes (1852).
[2] Maidstone Assizes (1863).

In *R. v. Dalmas* the counsel for the prisoner contended that no person could cut the throat of another without having his clothes covered with blood, and that as it was not proved that there was any blood on the clothes, the prisoner could not have been guilty of the crime. The throat of the woman was cut while she was walking across Battersea Bridge, the prisoner having inflicted the wound from behind. In the case of Lord W. Russell, the act of murder was committed by Courvoisier while in a state of nudity. In *R. v. Muller* this line of defence was carried to a still greater length. Although the clothes of the prisoner were not produced, and the evidence showed that he had had time to change them, the counsel for the defence said, "Blood spurted out from the deceased, and there is no doubt his assailant, whoever he was, must have been covered with blood, or have been considerably stained with it." The wounds were of a contused nature and little blood was likely to have flowed at the time of their infliction.

The clothes worn by the assailant need not, therefore, be "covered with blood", nor "considerably stained". Setting aside these erroneous assumptions, the evidence may show that had blood fallen upon his clothes, the accused had ample time to dispose of them, and thus prevent a chemical examination of them.

In *R. v. Raven* (C.C.C., 1950) accused had battered two relatives to death in a living room of their home with a television aerial base. Chance resulted in their being found 45 minutes after the incident, and Raven, the nearest relative, was immediately called. He arrived in a clean suit, and a detective officer, having his suspicions aroused, made an excuse to run round to Raven's house—where search revealed a heavily blood-stained suit stuffed into the boiler of a kitchen stove, partly burned and still smouldering. Freshly washed shoes stood outside a back door.

In *R. v. Smith* the fact that too great reliance was placed upon the absence of bloodstains on the clothing of the accused, as adverse to the theory of guilt, appears to have led to a failure of justice.

The deceased was found with wounds in the throat of such a nature that they could not have been inflicted by the deceased himself, and might have been made by another person from behind. The accused was traced to the spot, and a cap belonging to him, and saturated with blood, was found under the dying man. In his charge to the jury the judge is reported to have said: "There were very slight, if any, traces of blood upon his clothes, and it appeared (to him) impossible that the person who committed this deed should not have been deluged with blood from the wound," etc. The medical evidence was to the effect that there were some stains of blood on the clothes which were damp; they had been washed. The jury acquitted the prisoner.

In the Eltham murder case (*R. v. Pook*), a young woman was found dead with grave injuries about her head inflicted by a plasterer's hammer. One of the wounds divided the temporal artery. The prisoner's clothes were examined by a medical man who found upon them numerous small spots of blood, apparently recent. The judge, in charging the jury, said: "Was it likely that the person who inflicted all that violence, dividing arteries as he did in some places, could have done it without considerable marks of blood being afterwards found upon his clothes?"

This question, if addressed to a medical witness who had had experience in examining such cases, would have been answered in a very different manner: the spots were just such as might have arisen from a blunt weapon inflicting these wounds. The effect of spurting from the divided temporal artery would have depended on the position of the assailant at the time, and in injury of this kind "considerable marks of blood" were not likely. Even when there has been a good deal of splashing, shown by the presence of spots of blood around the body of the deceased, on the walls, furniture, etc., it is quite common to find that the clothing of the assailant shows comparatively few stains: this fact must be kept constantly in mind.

Per contra, the presence of spots of blood on articles of clothing, knives, etc., taken from the persons of those who are accused of murder, may be

quite consistent with innocence. Small spots or stains have often an undue importance attached to them. Minute spots of blood on the shirt of a man tried for murder by wounding have been accepted as evidence of guilt, until it was explained that they were probably derived from flea-bites, and that some were on one side and some on the other, showing that the shirt had been worn on the two sides. The coarse clothing worn by manual workers may acquire blood-spots from a variety of accidental circumstances which the wearer may not always be able to explain. When an attempt has been made to wash out the stains, or the accused admits they are there, and shows great anxiety to give some explanation of their presence, as that he had assisted in killing a pig, rabbits, or rats, or that he had been carrying game, there may be some ground for suspicion. Due allowance should always be made for the accidental presence of blood.

Whether blood is or is not found on the clothing of a person charged with murder, any wounds or marks of violence upon him should be specially examined. These may have been produced in a struggle with the deceased, and the accused may not be able to give any consistent account of the time or mode of their production. A case has been related (p. 254) in which the identity of an assailant was to some extent established by the form of an ecchymosis on the face. Such a wound may be found on a suspect, and he may pretend to account for by some accident, or in order to evade suspicion. His statement may, however, be wholly irreconcilable with the appearances of the injury. The kind of weapon used, and the period at which the wound was inflicted, may sometimes be inferred from a simple examination and prove that the prisoner's story is false. A case of this kind was tried, in which an assailant was identified by the peculiarity of a wound on the knee.

He had broken into a house at night with some others, and discharged his gun at the prosecutrix, while he was in the act of kneeling or stooping. The gun burst, and the recoil of the breech produced a mixed laceration and contused wound on the knee of the assailant. When the prisoner was called upon to account for this wound, he referred it to an accidental blow from a mandril some time before. The appearance of the injury was, however, inconsistent both with the time of its alleged accidental infliction and with the instrument said to have produced it; while, on the other hand, it was proved to correspond with such an injury as the broken breech of the gun would have produced at the date of the burglary. This led to the identification of the prisoner, and to his subsequent conviction.

Two men were charged with having assaulted, with intent to rob, a surgeon who, while he was walking along a lonely road in the country, overtook three men who were strangers to him. One knocked him down by a severe blow on the face and held him, while another put his hand upon his mouth to prevent his giving alarm. One of the men contrived to get his finger in the surgeon's mouth and during the struggle the latter bit off the end completely between the nail and the first joint. The piece of finger was given to a constable, who eight hours later found one of the men with his hand bandaged. The tip of one finger was missing. The man accounted for this by saying that he accidentally cut it off, but on comparing the piece of finger with the injured finger of the man's hand, they were found closely to correspond. He and his companions were convicted.

The body of a girl was found near a hedge in a direct line with the back of the street in which she lived. Her feet were tied with a rope. Her feet also were tied together, and the rope went three times around her waist. The throat was deeply cut, and a piece of rag tied around it. The back-door catch of the house where the accused lived with his father showed signs of bloodstains. At one o'clock a police witness saw the accused in the house in his shirt on which were several spots of blood. There was blood on his hands also, and the forefinger of each hand had been freshly cut. The accused said that he cut his finger with his pocket-knife. The kitchen towel was smeared with blood. A bloodstained razor was found in the

kitchen. It looked as if it had been newly cleaned. A piece of rag was found which corresponded with the piece which was tied around the girl's neck. The accused's trousers and waistcoat were bloodstained. On the shelf in the coal-house in the accused's house the girl's Tam-o'-Shanter hat was found with blood upon it. The jury returned a verdict of wilful murder.

These cases illustrate the importance of examining a suspect soon after a crime.

WOUNDS OF SPECIAL REGIONS

Some of the foregoing general principles must now be considered as they apply to special regions of the body. Cut throat has already been mentioned in many connections; it will not be dealt with further.

We shall consider the following:—

> Wounds of the scalp, cranium and brain.
> Wounds of the face, mouth and teeth.
> Injuries to the spine.
> Wounds of the chest wall, lungs, and of the heart and great vessels.
> Wounds of the abdomen and its contents:—
>> (a) liver and gall-bladder.
>> (b) spleen.
>> (c) kidneys.
>> (d) stomach.
>> (e) bladder.
>> (f) genitalia.
> Fractures, other than those of skull and spine.
> Dislocations.

WOUNDS OF THE SCALP, CRANIUM AND BRAIN

Scalp. Wounds of the scalp from mechanical violence must be looked upon as potentially serious, no matter how they are produced, for though serious scalp wounds often heal in a remarkable manner, should the skull also be injured these wounds are particularly liable to give rise to fatal complications owing to the ease with which pyogenic organisms can reach the brain. The loose manner in which the scalp is attached to the cranium affords further facilities for the spread of inflammation and suppuration.

There is still a further reason for considering scalp wounds dangerous in that it is frequently difficult to be sure whether or not to what extent the skull or the brain has been damaged. Severe or fatal brain injury may be caused without particular damage to the scalp and in this connection the presence of a good crop of hair or of stout headgear may be of importance. The "crash" helmet has undoubtedly saved many lives.

Owing to the free manner in which the scalp moves on the closely subjacent bone, injuries produced by blows from blunt instruments frequently bear a close superficial resemblance to cut wounds. It is advisable, therefore, in all scalp wounds to shave the scalp closely and examine the edges and terminations of the wound with special care to see if the tissues are cut or torn. The presence of foreign bodies, such as fragments of glass, fibres, paint, etc., may provide important clues to the nature of the wound: metal fragments torn from vehicles are sometimes found in the depths of impact injuries.

Cranium and Brain. Brain injury may be evanescent, leading to but a momentary functional upset; it may be more intense and lead to concussion

or temporary loss of consciousness; or it may cause more obvious physical damage, such as contusion or laceration of the membranes or of the brain itself.

Death may occur immediately, but as a general rule, unless the damage is extensive, injury to the brain is rarely the cause of sudden death. Concussion is instantaneous, and takes place at the moment of injury. The violence may, however, lead to intra-cranial hæmorrhage or œdema, in which case the whole effect may not be observed for some time after the injury. Infection of the meninges or brain may not develop for a considerable time after the infliction of injury.
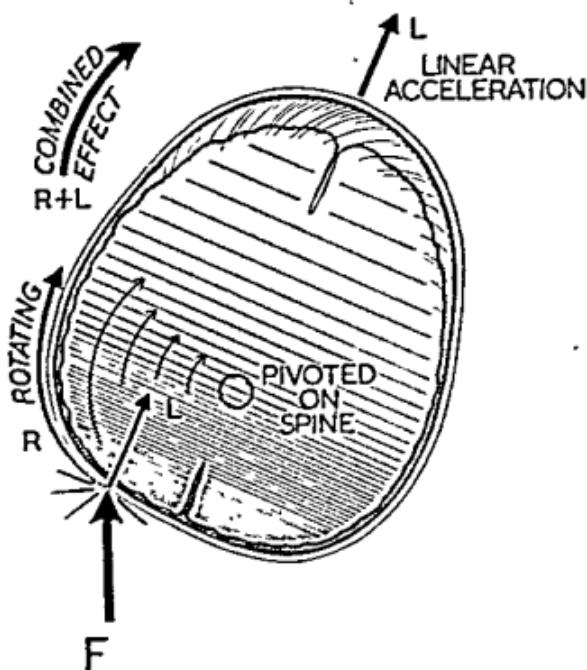
Fig. 26. Diagram to show the complex physical problems involved in blunt injury to the head. It shows the resolution of a force (F) into linear and torsion strains and the drag caused by momentary lagging of the brain within the skull. Rarefaction and piling up in the brain are exaggerated.

The Mechanism of Cranial Injuries. Certain basic physical principles, which are essential to a clear understanding of head injury, must be stated first:

1. The skull except in infancy is not easily deformed by compression owing to its architectural strength: it more easily fractures, and the fragments may become depressed or angulated, and fissures opened out.

2. The brain is not readily compressible: it is easily lacerated or torn and may be displaced by hæmorrhage or by the growth of a tumour, but room has to be found for the same volume of brain elsewhere when this is so.

3. Movements of the head as a whole are synchronous with movements of the skull but the brain tends to lag momentarily whilst its inertia is overcome, and either linear or torsion strains are thus set up. Furthermore,

when the head comes to rest, as when it meets a resistant object, the brain continues to move forward in the direction of the blow in virtue of the momentum acquired and is thus injured by those forces which resist its movement.

4. It is changes in the *rate* of movement (acceleration/deceleration—or torsional) *that are of greatest importance in producing tearing injuries.*

Whether the whole head or a small region or tract is affected depends on the nature of the agent. A heavy blow from a sandbag is likely to cause acceleration or twisting of the whole head and produce widespread contusion and torsion of the brain, whereas a blow from an instrument with a smaller striking surface is more likely to cause a localized depressed fracture or to penetrate the skull. The clean cut hole made by a high velocity bullet shows this localized effect in a marked manner. In general, the smaller the area absorbing the force of an impact, the more likely is it that local head injury will follow.

If the head lies on the ground no acceleration/deceleration changes are possible, though torsion strains may suddenly develop if the head is suddenly twisted. *Contre-coup*—which depends on acceleration/deceleration strains—is, therefore, not likely to be seen if the head is struck whilst on the ground.

Injury to the membranes or to the brain results in (a) an immediate functional upset, often concussion (b) hæmorrhage and (c) œdema which increase the pressure locally, displacing neighbouring brain and forming the pressure cones around the brain stem which reflect any increased intra-cranial tension.

We must now devote a certain space to the consideration of the results of violence, concussion, contusion, laceration and hæmorrhage.

Concussion. Concussion may be defined as a state of unconsciousness or impaired consciousness suddenly produced by mechanical force applied to the skull and often followed by a varying period of retrograde amnesia. There are many theories to account for this clinical state.[1][2][3] There is complete loss of reflexes, almost imperceptible pulse, slow sighing respiration, and cold, clammy skin.

The shock may be sufficient to inhibit completely the vital processes, and death may result. As a general rule, however, the patient revives after a few minutes with symptoms of headache, giddiness, weakness and vomiting, the result of microscopic injuries and of post-traumatic œdema.

If death occurs, the *post-mortem* examination may reveal no naked-eye lesions, but as a general rule bruising or laceration of the brain or scattered petechial hæmorrhages, œdema, foci of myelin degeneration, etc., are to be found.

Recovery may be complete, or there may be an irritative condition, probably the result of small contusions and subsequent œdema of the tissues around them. The commonest sequelæ are headache, which may be of a most persistent and distressing nature, loss of memory, and attacks of giddiness. More grave sequelæ, such as epilepsy, are uncommon.[4]

Feiling[5] puts the incidence of epilepsy after closed injury at 2·5 to 3·5 per cent and open injury at 4·5 to 4·9 per cent.

[1] Denny-Brown, D., and Russell, W. R., 1941. *Brain*, 64, 93.
[2] Cairns, Hugh, 1942. *R. Soc. Med.*, 32, 200.
[3] Rowbotham, G. F., 1949, "Acute Injuries of the Head", 3rd Ed. Edinburgh: Livingstone.
[4] Gibbs, F. A., 1946. *J. Clin. Psychopath.* 8, 58.
[5] Feiling, A., 1951. Modern Trends in Neurology. London: Butterworth.

· Loss of memory for events occurring just before the injury is constant, and is most important from a medico-legal standpoint.

Contusion. When the skull is shattered locally by a blow, local bruising or laceration of the membranes and of the underlying brain are likely to follow: no more need be said of this except that sub-membrane hæmorrhage, ensuing as a consequence of this, is a lesion described separately (*vide* infra).

When, however, some broader area absorbs the momentum of impact, the whole skull is suddenly moved from a state of inertia (or brought violently to a standstill). Sudden changes of the rate of movement cause a widespread disturbance of the contents of the cranium as we have stated above. Thus any force accelerating (or decelerating) the skull causes a pile up in the region of impact and a rarefying or stretching over the opposite surface which may result in local compressions and antipodal stretching injuries.[1]

Sudden rotation of the skull is more gradually imparted to the C.S.F. and brain by means of frictional force and the pull of tethering vessels— which may tear and bleed. The brain may even "twist-tear" its own substance as a result of this torsional strain, developing whilst inertia is being overcome (or rotation brought to a standstill) and this may result in widespread surface contusion of the convolutions.

Hæmorrhage. It is obvious, of course, that hæmorrhage may occur as a result of trauma of the brain or its membranes and there is no doubt that reactionary œdema and oozing of blood from the injured brain or its membranes are responsible for the deaths that occur in patients several days after an injury.

Apart from this effect, violence applied to the head may cause free hæmorrhage between the dura mater and the skull (extra-dural hæmorrhage), between the dura and pia arachnoid (subdural hæmorrhage), under the arachnoid (sub arachnoid hæmorrhage), or into the brain matter.

In traumatic hæmorrhage there is, as a rule, a distinct interval between the application of the violence and the onset of symptoms. The victim may have lost consciousness by concussion, and may have apparently recovered before the gradual increase of pressure due to the hæmorrhage is able to produce pathological effects. This interval may vary from a few minutes to several hours or even several weeks.

Alcoholic Intoxication v. Head Injury. Alcohol and other intoxicants may cause effects which, on occasion, may be diagnosed only with difficulty from the symptoms produced by injury. Conditions of shock or concussion are often attributed to drunkenness: the reverse is less frequent.

There is nothing in the state of the brain in a dead body which will enable a practitioner to say whether shock or intoxication had existed and had been the cause of the symptoms which ended fatally. The discovery of alcohol in the stomach or in the blood or urine might lead to an assumption that the deceased had been drunk, and marks of violence on the skull or in the brain might prove that he had been injured, but obviously neither of these findings, and assuredly no negative findings, would enable us to solve the problem whether alcohol or injury was the principal or sole cause of death. We must get our answer, if one is possible, before death. The following are the principal directions in which to seek it:

The History of the Case. This, if obtainable, may decide the matter, but

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[1] Holbourn, A. H. S., 1943, *Lancet*, 2, 438.

sometimes it may be very incomplete; for example, the person may have been found insensible by someone; or the history may be intentionally misleading.

Smell the Breath. A smell of drink does not preclude the possibility of injury to the head; alcohol may have been given with the object of reviving. If there is no odour of spirits or beer, etc., the presumption is that the symptoms are *not* due to intoxication. It must be remembered also that the breath of a drunk person does not have the clean pungent smell of alcohol, but has a sour, often rather foul, smell. On the other hand, intoxication may be so severe as to introduce the risk of death from this cause alone; concomitant marks of violence must not be allowed to draw attention away from the intoxication.

Note the Pupils. If they are dilated it may indicate fairly severe shock or alcohol may be suspected; if contracted, pontine hæmorrhage or cortical irritation may be suspected; if unequal, they rouse a strong suspicion of serious head injury; if inactive to light, the case is serious, whatever be its precise nature, and must be carefully watched. If both pupils react sluggishly to light, it is in favour of regarding the case as one of drunkenness.

The condition of the pupils in alcoholic coma is now established and finally accepted as it was stated to be by Macewen many years ago. If a person in simple alcoholic coma be allowed to lie still for half an hour or so, his pupils will be found to be contracted; if external stimulation be applied, such as pulling the ear, slapping the face, or pulling the patient about, the pupil will dilate; on leaving him alone they will again contract. This activity of the pupils to stimuli other than light, with their subsequent return to the *status quo ante*, is practically a pathognomonic sign of alcoholic coma.

Take the Temperature. If raised, this suggests head injury and possibly a hæmorrhage into the brain (pons) although in the early condition of shock it may be subnormal; if lowered, this in itself signifies danger, but it does not differentiate the source of it.

Measure the Respiration. If shallow and slow, or irregular, it indicates a state of shock. Eructations, puffing and long heaving sighs are more common in drunkenness.

Take the Pulse Rate. A pulse rate of 120 or over generally means that the patient is in a state of shock. Lowering of the pulse rate to 60 or less generally indicates a rising intracranial pressure.

Localized Paralysis as opposed to general helplessness suggests a local lesion, and therefore strongly suggests serious injury, and not intoxication.

Examine the Urine. This may differentiate diabetic coma; it may suggest kidney disease with hypertension and a cerebral lesion—or uræmia. The presence of albumen or blood will aid in the diagnosis; the alcohol can be measured, and a relative blood level estimated.

Note the General Condition of the Skin. Flushed and sweating, probably drunk; cold and pale, collapse of a dangerous character; cold and sweating suggests opium poisoning.

If these points are carefully attended to, an answer to our question can generally be obtained. We leave the matter with the following remarks by Taylor, which are accurate today as when first penned:

It is to be feared that medical witnesses are not sufficiently careful on these occasions to determine whether there are any signs of intoxication about an injured person. Subsequent proceedings may render this a material part of the inquiry. Many a house surgeon of a hospital has been severely blamed for an omission to inquire and satisfy himself whether, in addition to the results of violence, a man

who has been brought into hospital has or has not been intoxicated when admitted. The question is of importance: the injuries to the head may have arisen from a fall, and a drunken man may readily meet with such *injuries from accident. There can be no excuse for not making a full inquiry into the precise condition of an injured person, and arriving at the best judgment of which the case admits.* A state of intoxication renders it difficult to form an accurate opinion in a case of alleged criminal wounding; but it is always in the power of a witness to satisfy himself by close examination, the use of the stomach-pump, or simply watching the patient, whether he is in a state of drunkenness or whether he is labouring under the effects of disease or violence. In several instances within a recent period persons who have been struck with incipient symptoms of apoplexy in the streets have been seized and locked up as drunk, and have soon afterwards been found dead or dying. Others, who have suffered from violence, have perished from neglect under a similar mistake made by a medical man or by the police. Disease of the brain, as well as injuries to the brain from violence, may give to a man a staggering gait and render him helpless; they are also commonly accompanied by stupefaction and vomiting. If it should happen that shortly before such an attack the person has taken beer, wine, or spirits, sufficient to give an alcoholic odour either to the breath or the matter vomited, it is at once treated as a case of drunkenness, and the unfortunate person is left to his fate.

Intracranial Hæmorrhage—Violence or Disease. The importance of this question, as well as the frequency with which it arises, requires a somewhat lengthy and exhaustive analysis of the problem.

Blood may be found effused in various situations within the skull. The hæmorrhage may be due to violence, to disease, or, in certain circumstances, to violence aided by the presence of disease. By careful examination in the *post-mortem* room it is possible to separate the lesions which are due to violence alone from those due to disease alone. In cases in which the final effects of disease may have been precipitated by violence, evidence other than that found at the necropsy may be required before a definite opinion can be expressed.[1]

Special attention must be given to the following points in *the post-mortem examination of the head.*

(1) Cuts, lacerations or bruises of the scalp and face. These are of importance in so far as they throw light on the nature and degree of the violence that has been inflicted.

(2) Condition of the intracranial venous sinuses and large veins as seen *on removal of the skull cap. Examine for laceration or ante-mortem throm-bosis.* The superior longitudinal sinus should be examined and opened before cutting through the dura for removal of the brain, the remaining sinuses and veins immediately after removal of the brain. Thrombosis in the sinuses occurs not only as the result of inflammation, but in wasting diseases (marasmic thrombosis), especially in children. It may cause petechial hæmorrhages in the cerebral substance. The following is an example of the importance of examination of the venous sinuses. In this case the question of legal interest was whether the condition was due to disease or poisoning. Had there been a history of a quarrel, violence might well have been suspected.

A girl, aged 18, was brought to London Hospital by her "sweetheart." Illness commenced suddenly on the previous day with giddiness, vomiting and headache. In hospital the girl had intermittent attacks of rigidity and progressive coma. Death occurred on the third day after onset. The mother accused the man of having had an abortifacient administered. The man said that he had taken the girl to a chemist to obtain medicine to relieve the headache. At post-mortem there was found a thrombosis of inferior longitudinal, straight and left lateral sinuses, and

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[1] Jefferson, G., 1931. *Surg. Gynec. Obstet.,* 93, 444.

of the veins of Galen and veins of corpora striata; small hæmorrhages and softening in basal ganglia; the condition was evidently a natural "thrombosing encaphalo meningitis."

(3) The exact site of the hæmorrhage, which may be—
- (a) Between the bone and dura mater, i.e., *extra-dural*.
- (b) In the *subdural* space, that is between the dura mater and arachnoid membrane.
- (c) In the *subarachnoid* space.
- (d) In the substance of the brain matter, i.e., *intra-cerebral*.

(4) Fractures of the skull. The dura must be removed to prevent fractures escaping notice; those of the calvarium are more easily found than those of the base.

(5) Condition of middle ears and mastoids, sphenoidal and frontal sinuses. Open these with a chisel to see whether acute or chronic inflammation is present.

(6) Condition of the cerebral arteries. Dissect up all the larger arteries carefully. Examine for atheroma, developmental or mycotic aneurysms, ruptures, etc. Open lumen of arteries with scissors, to look for thrombosis or emboli.

(7) Note the exact positions of softened infarcts or hæmorrhages in the superficial part of the brain substance; then, after incising the brain, note their relation to the vessels in the deeper parts.

(8) When hæmorrhage within the cranium is due to disease, this is frequently only a part of a disease present elsewhere, like hypertension or polyarteritis—which must not be overlooked.

We may now lay down a few rules of cardinal importance regarding lesions due to violence.

(1) Fractures of the skull are found at, and radiate (in the direction of the causative force) from, the point of impact upon the cranium, with the following rare exceptions due to the nature of the violence: When a heavy weight, especially an elastic weight, such as the pneumatic tyre of a heavy vehicle, passes over the brow or occiput, the only fractures may be horizontal cracks in the lateral region; the skull has been compressed from before back, has expanded laterally and cracked laterally. Cracks, due in the same way to over-expansion, are occasionally present, in addition to other fractures, in falls from a height. The impact and passage of a rifle bullet may cause cracks in the skull, isolated from the fractures at the points of entry or exit.

(2) Lesions to the soft parts within the skull are more pronounced either beneath the point of impact (and any fractures radiating therefrom) or on the opposite side of the cranial cavity, owing to "pile-up" and "rarefaction" (*vide supra*). Those on the side of impact are usually slighter—unless fracture is present.

(3) The lesions on the opposite side (provided there be no fracture there) are due to contre-coup (see p. 303). The cause of these lesions has been set out above. The movement of the brain upon impact lags behind the movement of the skull, drawing the brain away from the opposite side, thus stretching and tearing the perforating vessels.[1] *Contre-coup* lesions always lie in the line of the force of impact. Thus, if a man falls upon the back of his head, striking the ground with his occiput a little to the right of the middle line, the lesions occur over the left frontal and temporal poles; the

[1] Denny-Brown, D., and Russell, W. R., 1941. *Brain*, 64, 93.
[2] Holbourn, A. H. S., 1943. *Lancet*, 2, 438.

right frontal and temporal poles may also be affected, but to a less degree.
If the portion of the occiput struck lies over the central horizontal plane of
the brain, then the lower aspects of these poles will be affected; if below,
then the upper aspects will be affected. *The importance of this position of
contre-coup lesions cannot be overestimated.* Not only does it enable *contre-
coup* lesions to be recognized with certainty and thus disease to be excluded
as a cause of them, but it is frequently of use in other ways. Thus if a man
has *contre-coup* lesions in the sites given above, no fracture of the skull, and
a bruise upon the forehead, then these intracranial lesions are certainly
due to impact on the occiput; they are not the direct result of a blow on the
forehead, though the bruise on the forehead may be evidence of a blow which
caused the man to fall upon his occiput.

Torsional injuries may occur over the surface of (and within) the brain
when the head lies on the ground, but the forces of "pile-up" and "rarefaction"
which cause *contre-coup* cannot do so.

This statement is obviously of the highest degree of importance in cases
of quarrels amongst drunken men when the evidence regarding blows given
or received is so disputable.

Contre-coup may cause groups of barely visible pinhead hæmorrhages,
larger areas of disruptive hæmorrhage, ruptures of the pia-arachnoid mem-
branes or actual laceration of the brain substance.

These cardinal rules in respect of lesions due to violence may now be
supplemented by a review of the causes of hæmorrhages in the meninges and
brain, with points for the differential diagnosis between trauma and disease.
The question of trauma *plus* disease will receive separate discussion.
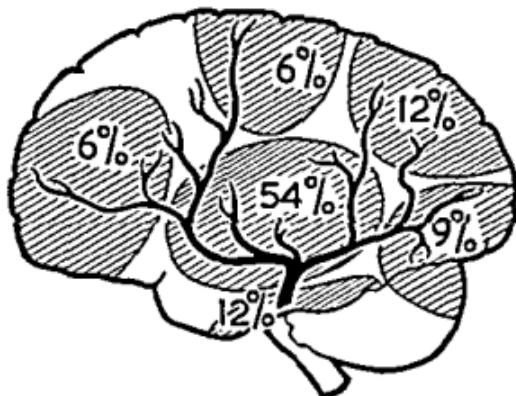
FIG. 27. Frequency of site of extra-dural hæmorrhage from trauma to menin-
geal arteries or veins (after Rowbotham). "Acute Injuries to the Head",
E. & S. Livingstone Ltd.

Causes of Hæmorrhage into the Meninges. (1) *Hæmorrhage between
the bone and dura mater.* Extra-dural hæmorrhage is due to fracture of the
skull, or rupture of a meningeal artery, usually in the course of a fracture, or
to tearing of the venous sinuses, also usually associated with fracture of the
bone.

In infancy and old age the dura is more tightly adherent to the skull, and
extra-dural hæmatoma is less common, but in adolescents and young adults

local blows may cause tears of the meningeal arteries (or concomitant veins) with or without fracture. About half of these are in the temporal region[1] and arise from injury to the middle meningeal vessel. The rate of development of pressure symptoms varies according to the size and nature (artery or vein) of the vessel torn, but is usually a course of some hours; a "lucid interval" may occur after the injury to the head, tending to dissociate that incident from the hæmorrhage causing later symptoms and often death.

A boy of eight, playing with fellow schoolboys at 4.30 p.m. was struck on the left temple by a half-brick. He staggered and fell, momentarily concussed, but got to his feet and ran home. He ate his evening meal at 7 p.m. and went to bed at 8.30 without making any complaint. At 7.30 next morning he was found sick in bed, and as he could not be roused he was removed to hospital, but on arrival was found to be dead.

(2) *Hæmorrhage into the subdural space.* Subdural hæmorrhage is relatively common after any kind of violence to the head. Such hæmorrhage may rarely be caused by laceration of one of the venous sinuses when it is likely to cause rapid symptoms and death, or more commonly by a tearing of one or more of the small perforating veins between the pia and skull. This latter type of bleeding is slow and the violence applied may have been relatively trivial; the hæmatoma may cause few symptoms. The layer of blood clot is rapidly encapsulated by a thin cellular membrane—a process which begins within a few hours, and which is completed within a few weeks. Granulation tissue is found on the dural side and spontaneous bleeding may occur from time to time from the thin walled capillaries of this tissue leading to progressive enlargement. It may be found as a cyst of liquid blood clot as a brown mass more than an inch thick, years later. This condition, known as pachymeningitis hæmorrhagica interna, formerly believed to be due to an inflammatory process, is now generally conceded to be caused by trauma since the classic work of Trotter.[2] It is more liable to be found in the aged in whom it may cause little change—slight confusion only being common.

Gardner[3] suggests that the increase in size of these hæmatomata is due to osmosis of cerebro-spinal fluid into the tumour caused by the increase in molecular concentration due to the disintegration of the clot. The contents of the hæmatoma support this theory for they may be partly or wholly fluid and the fluid may be black and viscous or brown and watery.

(3) *Hæmorrhage into the subarachnoid space.* This may be due to trauma, to spread of hæmorrhages which originally were in the cerebral substance, more commonly to rupture of aneurysms on the internal carotid or main cerebral arteries[4], and rarely to inflammatory necrosis of these arteries. Encephalitis, or blood diseases like leukæmia are very occasionally concerned.

Trauma is a common cause of subarachnoid hæmorrhage. It is then usually associated with contusion or laceration of the cortical substance. The bleeding is rarely localized, but tends to spread widely over the surface of the brain into the sulci, and mixes freely with the cerebro-spinal fluid.

The spread of blood from the cerebral substance may occur not only when such hæmorrhage is near the surface of the brain, but also when bleeding into the deeper part of the brain matter has escaped into the ventricles, and basal cisterns, through the roof of the fourth ventricle.

[1] Rowbotham, G. F., 1949. "Acute Injuries of the Head". 3rd. Ed. p. 16. Edinburgh, Livingstone.
[2] Trotter, Wilfred, 1914. *Brit. J. Surg.,* 2, 271.
[3] Gardner, W. J., 1932. *Arch. neurol. Psychiat.,* 27, 847.
[4] Helpern, M., and Rabson, S. M., 1950. *Amer. J med. Sci.,* 220, 262.

Apart from irregular aneurysmal dilatations in severe atheroma, cerebral aneurysms are due to congenital weakness, or rarely to infective emboli. Aneurysms due to infective emboli are usually present in the sulci on the convexities; the source of the emboli will be found elsewhere, in the great majority of cases in an ulcerative endocarditis in young subjects. Congenital aneurysms are a common, though often overlooked, cause of hæmorrhage into the subarachnoid space.[1] They may occur singly or multiply and may rupture when the cerebral arteries are otherwise healthy, and when there is no abnormality elsewhere in the body. When they rupture, the blood frequently escapes not only into the subarachnoid space but tears through adjacent cerebral substance reaching the ventricles. One of the commonest sites is at the junction of the anterior communicating artery with one of the anterior cerebral arteries; in this site they may only be revealed by separation of the lips of the anterior extremity of the great longitudinal fissure.

Developmental aneurysms are, therefore, of great medico-legal importance for they may be the cause of death in cases in circumstances which might have given rise to suspicion of foul play, or their sudden rupture in the driver of a vehicle may be the real cause of a serious accident.

A car, driven by a man of 41, swerved unaccountably into oncoming traffic and collided with the offside of a charabanc. No defect was found in the steering mechanism nor any reason for the swerve. Autopsy, however, revealed a ruptured developmental cerebral aneurysm bursting into the floor of the third ventricle.

In every case of subarachnoid hæmorrhage a careful dissection of the cerebral vessels especially in the Circle of Willis and branches from it must be carried out. The dissection may be carried out under water, the clot being washed away with the greatest care, or injection of the vessels with a coloured dye may help in finding the source of the hæmorrhage. In Helpern and Rabson's series no aneurysm could be found in 23% of cases of rupture in spite of diligent search.

Hæmorrhage into the Cerebral Substance.

(1) *Capillary hæmorrhages* are found in encephalitis, in softening due to arterial embolism (very rarely fat embolism), to arterial thrombosis or sinus thrombosis, to diseases of the blood such as leukæmia, anæmia and purpura, to septicæmia, to toxæmia, of both endogenous and exogenous origin, to fits, to violent coughing, and of course in asphyxial states.

The causes of such hæmorrhages are revealed by the examination of the contents of the cranial cavity, for instance emboli in arteries, or by examination of the rest of the body. Microscopic examination is required to diagnose fat embolism, and encephalitis.

(2) Large non-traumatic hæmorrhages in the "sites of election" in the cerebral substances are usually the result of rupture of a deep perforating artery. Large intra-ventricular hæmorrhages occasionally occur in cases of puerperal toxæmia, in which there have been no fits. These are usually situated in either the corpus structures or the pons; when intra cerebral hæmorrhages are not so situated, search should be made for some other cause.

(3) A large hæmorrhage not infrequently arises from a glioma or angioma of the brain; it may also arise from a secondary growth, particularly spongio blastomata. It has already been stated that the cerebral substance may be torn up by blood from ruptures of infective or developmental aneurysms on arteries in the subarachnoid space.

¹ Symonds, C. P., 1924. *Quart. J. Med.*, 18, 93.

When hæmorrhages result from rupture of a deep perforating artery there is either evidence of *extreme degeneration of the cerebral arteries or of high* blood-pressure. Usually there is evidence of both conditions. The hæmorrhages usually occur within the basal ganglia or pons, rarely in the cerebellum. Hæmorrhages arising in tumours are, as a rule, readily recognized, but large hæmorrhages are sometimes found arising near the surface of the cerebellar lobes in apparently healthy young people in whom there was no naked-eye explanation of the lesion, but in microscopic sections varicose angiomatous veins, with imperfectly developed walls, were found—part of the Lindau syndrome.

Traumatic hæmorrhages in the cerebral substance can be identified by exclusion of other causes and, particularly, by attention to the cardinal rules for traumatic lesions given above. It was mentioned that an exception to these rules has been noted thus: *Sometimes hæmorrhages within the central parts of the brain substance, particularly splits in the pons, result directly from trauma;* such pontine hæmorrhages are neither beneath a fracture nor in the position of a *contre-coup* lesion. In such cases they are due to torsion strains. Whether an associated lesion in the scalp or skull is evidence of trauma which caused the hæmorrhage, or whether the scalp or skull were injured by a fall due to unconsciousness caused by a non-traumatic hæmorrhage is always a difficult decision to make, but if the arteries are healthy, and the heart affords no evidence of a previously existing persistently high blood-pressure, but there is evidence of trauma, then such a hæmorrhage is presumably traumatic. If, however, the vessels are degenerate, and they often are in these cases, other evidence than that obtained by necropsy may be required before an opinion can be expressed.

Disease plus Violence. It is now necessary to say something concerning hæmorrhages which could have resulted from disease alone, but in which violence may have been, or is alleged to have been, the final and actual cause.

An old man of 72, known by his family doctor to be hypertensive, tottered to the head of the stairs at the rear of a moving bus and was seen by a fellow passenger on the upper deck to sway, make no attempt to clutch at the rail, and 'crumple up' on the stairway, rolling out of sight: he came to rest on the rear step of the bus, head down, feet projected up the stairway. *Autopsy revealed a fractured skull with heavy local and contre-coup bruising of the brain, together with a left corpus striatum hæmorrhage of the kind normal to hypertensive stroke lesions.* The commencement of the fall was attributed to this, but, though likely, there remains a possibility that the whole of the injuries might have been due to the fall.

When disease of the following kinds is found, then a sudden rise of blood-pressure, due to excitement however caused (alcohol, scuffle, assault, etc.) may be the actual cause of hæmorrhage. The disease conditions are: cerebral aneurysms, degeneration of cerebral arteries, evidence of a previously existing persistently high blood-pressure, erosion by inflammation of a cerebral artery, pachymeningitis hæmorrhagica interna, and cerebral tumours, especially angiomata. If hæmorrhage arises from one of these disease conditions, and there is evidence of a *scuffle* or *post-mortem* evidence of violence, such as recent bruises on the body which cannot be explained by a fall due to unconsciousness, then it is impossible not to admit excitement—or a disturbance by trauma—as possible ultimate causes of the hæmorrhage. Excitement can undoubtedly cause rupture of vessels when such disease is present. On the other hand excitement and drunkenness are not sufficient to cause hæmorrhage

when such disease is absent, unless the excitement is associated with extreme congestion. In some people intense anger or excitement may cause a condition very similar to that of a fit. Fatal cerebral hæmorrhage is very rare, however, even in true epileptic fits. In medical evidence the effect of excitement has undoubtedly been overrated far too often.

By a careful study of all the circumstances and *post-mortem* conditions it should be possible to arrive at a definite conclusion in most cases. In the remainder the *pros* and *cons* may be very evenly balanced, and the medical witness may be compelled to leave matters in doubt. The doctor must remember that it is not his special business to obtain a verdict, but to give only evidence that seems fair, and leave the results to the jury. The following propositions provide guiding principles in this problem:—

1. That multiple bruises of the brain are never found as the result of disease *only*, except when the disease causing them is *abundantly manifest from evidence derivable from autopsy*, or from the history, e.g., scurvy, purpura, hæmophilia leukæmia.

2. That a definite hæmorrhage (with evident clot) in the substance of the brain, or in the ventricles, is practically never the result of violence *only*, but it is a very frequent result of disease alone, or of disease *plus* excitement, or disease *plus* slight violence, such as a fall on soft earth causing a fairly severe *shake* of the brain.

3. That the younger the patient, the rarer it is to find definite hæmorrhage or capillary oozing *in the substance of the brain* without violence; but even in young subjects they may occur at times, e.g., from deep suboxia, or in polyarteritis or from encephalitis or angioma. They are not very uncommon in newborn children, as the result of anoxia during childbirth.

4. That sub-arachnoid hæmorrhages are usually the result of injury, but also commonly occur in disease, and often from spontaneous ruptures of developmental aneurysms.

5. That a cortical hæmorrhage from violence is always found most marked either immediately under the spot struck, or on the opposite side by *contre-coup*, or at some point under extention of a fracture caused by the violence. When under the spot struck there should be either a superficial bruise of the scalp, indicating the spot, or a fracture of the bones, or a tear in the vessel causing the bleeding (usually the middle meningeal artery, or one of the perforating vessels). When from *contre-coup* there should be, in addition, a bruise or laceration of the brain.

A medical witness may be asked whether vessels may be ruptured by excitement. If he agrees, without any qualification, the court may assume that excitement may alone be responsible in the particular case on which he is being examined. This impression on the court is not always removed even by a careful re-examination. He should not, unless it be consistent with his own views, allow his answer to a *general* question to be made applicable to a *particular* case. If asked whether vessels might not be ruptured and blood extravasated by *mere excitement*, he should answer that though such an effect might undoubtedly follow, it was his opinion that it was not the whole truth in this particular case.

The following cases are illustrations of this kind of situation, and of the difficulties that may arise.

In a trial for manslaughter it was proved that the prisoner and the deceased had been wrestling. The prisoner had thrown the deceased with his head on a stone floor; he then seized him by the throat and beat his head several times against

the floor. The deceased died 19 hours afterwards. On inspecting the body a great quantity of coagulated blood was found beneath the scalp. There was a wound over the right parietal bone, an inch and a half in length, penetrating through the scalp, but no fracture of the skull. There was a quantity of extravasated blood on the opposite or left side of the head, and a rupture of some vessels on the inside of the skull. On the neck were two discolourations to the left of the windpipe, apparently occasioned by the pressure of two fingers.

The doctor, after giving this description of the *post-mortem* appearances, was asked whether, in his opinion, death was occasioned by the injury, He replied, "Death might or might not have been occasioned by it". This is the sort of answer that brings the medical profession into ridicule. In another case the judge was strong enough to expose such nonsense. The judge said:—

If it were proved that two people were fighting together, blows were struck, one fell to the ground and died, and afterwards internal injuries were found corresponding with the external marks of violence, no power on earth could persuade him that such blows were not the cause of death. The prisoner was found guilty.

There is a clinical point of interest in connection with intra-cranial hæmorrhage, viz., that when a natural stroke lesion seizes a person who is at the moment pursuing an ordinary vocation without excitement or drink or unusual exertion, it frequently clears up so far that the patient does not die, but lives for months or years in a more or less paralysed condition. In those cases in which violence plays a part, a fatal result is much more frequent. Hence, if it were proved that the violence was not great and that there were signs of previous hæmorrhage, such a fact might be pleaded in mitigation of punishment.

In this respect *R. v. Sullivan*[1] was of some interest:—

On April 11th an apparently healthy man was knocked down by the prisoner, and fell with his head upon the ground. Although he suffered from pain in the head, he had no medical advice until May 12th, and had in the meantime performed his duties. On the 29th May he came under medical care. There were marks of bruises on the head, impairment of vision, a faltering gait, and other symptoms indicative of a lesion of the brain. About June 12th he became insane. He recovered so far that he was about to be discharged, *four months* after the infliction of the *violence when the symptoms became aggravated, and death took place. On inspection* a clot of blood amounting to two fluid ounces was found between layers of an endothelial tissue, occupying the sub-dural space over the left hemisphere. The clot had evidently been there for some time, and the surface of the brain had been indented by its pressure. Another clot of old standing was found in the pons. The medical witnesses concurred in attributing death to the effusion of blood on the brain, and the effusion to the violence inflicted by the prisoner, although they stated that some additional effusion had probably taken place just before the last recurrence of symptoms. The prisoner was convicted of manslaughter.

Such cases today do not present quite so much difficulty, for recurring symptoms and delayed death in cases of subdural hæmorrhage and other pathological conditions of the brain are well-recognized consequences of injury to the head. Death may occur after a period of apparent recovery; it is well recognized that a person may receive an injury to the head which may eventually lead to a fatal issue but which may not produce grave symptoms at the time.

The changes that time produces in effusions of blood within the cranium, and the histological changes in the cerebral tissues after damage to the brain form an important basis to sound opinion. [2] [3]

[1] C.C.C., September, 1853.
[2] Denny-Brown, D., and Russell, W. R., 1941, *Brain*, 64, 93.
[3] Rowbotham, G. F., 1949. *Acute Injuries of the Head*. 3rd Ed. Edinburgh: Livingstone.

Recent effusions of blood are recognized by their red colour and the consistency and appearance of the clot or coagulum. After some days the clots acquire a chocolate or brown colour, and this passes gradually into an ochreous tint, which may be met within from 18 to 25 days after the violence. Clots of subdural blood undergo slower changes in structure and consistency; when old they are firmer and disposed in membranous layers or become cystic; they are adherent to the dura mater and the brain and the surface of this organ presents an indent indicative of pressure.

The following case, however, shows the necessity for caution in stating the exact date of an effusion of blood.

A woman, æt 70, threw herself from a window. The fall produced a severe lacerated wound of the scalp, laying bare the skull, and causing a simple fracture of the sternum and tibia. She died 31 days after the injury. On inspection there was a fracture of the left parietal bone, and between the dura mater and inner surface of the skull, near the left temple, there was a layer of coagulated blood, one-sixth of an inch in thickness and about two inches in breadth. In one place the clot had a brownish hue, but the greater part of it was still rather dark-coloured. On the right side there was a similar effusion of coagulated blood, but this was inside the dura mater and on the arachnoid covering of the brain or within the cavity of the arachnoid. This coagulum was everywhere of a *chocolate-brown* colour, showing that the process of absorption was much more advanced than on the left side. A large quantity of coagulated blood had been effused into the cellular tissue near the fracture of the tibia. This was still crimson, and had the appearance of a recent effusion. A small quantity of fresh blood was also found near the sternum, which had been fractured. The fractured ends of the bones had been firmly united. There was doubt whether these effusions had taken place at the same time from the same accident—i.e., 31 days before death—for they presented very different appearances on the inner surface of the serous membrane than in the other structures in which blood was effused. In estimating time, as indicated by change of colour in the clot, we must therefore always consider the seat of the effusion, the absorbing power of the tissues, and the possibility of previous injury.

Lucid Interval. In cases of injuries to the head causing extra-dural hæmorrhage a person may recover from concussion and apparently be going on well, when he may unaccountably deteriorate and die. Effusion takes place gradually, and after a variable period, irrespective of the person being excited or disturbed, the bleeding will menace life by increasing compression. How long is required in order that such an effusion should develop after an accident it is impossible to say, but in most cases it is *generally observed* to follow the injury within a few hours.

This "lucid" interval is in fact one of the recognized methods of distinguishing between mere concussion, extra-dural and intra-cerebral hæmorrhage. In the former, unconsciousness appears at once and gradually disappears as the patient recovers; in extra-dural hæmorrhage, on the other hand, there may be a momentary unconsciousness followed by apparent recovery, so much so that the patient resumes his occupation, for a longer or shorter period, minutes or hours, and then unconsciousness returns, and death follows. Frank contusions of the brain on the other hand, seldom permit immediate recovery of consciousness (as does mere concussion), the subject either remaining unconscious until death or making a slow return to full consciousness and recovery.

Taylor reported the case of a gentleman who was thrown out of a chaise, and fell upon his head with such violence as to stun him. After a short time he recovered his senses, and felt so much better that he entered the chaise again, and was driven to his father's house by a companion. He attempted to pass off the accident as of a trivial nature, but he soon began to feel heavy and drowsy, so that he was obliged to

go to bed. His symptoms became more alarming, and he died in about an hour from effusion of blood on the brain. (Whether extra- or sub-dural is not clear from the account.)

A woman of 70, stumbled and fell on a stairway at her home, striking her head on the carpeted floor. She was dazed and shaken and retired to bed. Next morning she appeared to have recovered and was able to attend her house duties. She was noticed, however, to be unaccountably vague and forgetful and tended to sit and doze quite a lot. Her condition became worse and four weeks later she was removed to an observation ward on a Receiving Order, dying three days after. Autopsy revealed a large cortical subdural hæmatoma, gelatinous and plainly some weeks old.

The following case is interesting and to the point, though the autopsy data were somewhat restricted:—

A man, of about 50, worked in the morning, and from about midday till 4.30 he sat in a public-house chatting and having an occasional drink. About 4.30 he mounted his cart to drive home. He drove in such a manner as to attract two neighbours from their work to stop the horse; they stopped it somewhat suddenly, and the man fell off the shafts on his face in the road. After this he had two, or possibly three, more falls, but finally was put into his cart with the local policeman to drive him. The policeman left him about 5.30, as he then seemed more himself and capable of driving. Within a few minutes he met a traction engine. He waved to the driver of the engine to stop and then got down and walked with his horse, which got more and more restive and finally bolted, pulling the deceased over and throwing him violently to the ground, the cart passing over him. He was picked up dead by the men on the traction engine

A *post-mortem* examination was made, with the following results: There was an abrasion on one malar bone, quite superficial: there were no other external injuries at all; internally there was found a clot of blood between the dura and the brain. Nothing else was found to which death could be attributed.

Damages were claimed by the widow against the owners of the traction engine. The evidence for the widow was that the man was somewhat under the influence of alcohol; that he was violently shaken by his final fall and died at once of shock from this fall.

The evidence for the owners of the engine was that the man was somewhat under the influence of alcohol and excitement; that these, combined with the admitted falls (antecedent to the fatal one) started a meningeal hæmorrhage, which, after reaching a certain degree, ceased at that degree, until the excitement of the attempt to stop his horse and the violence of his fall caused it to recommence and increase and so bring about death by compression.

The judge awarded the widow £100 damages, but he gave no reasons for his decision. Blood requires time to accumulate and there was an interval of two hours between the first fall and death, whereas death is stated to have occurred immediately after the second fall. A careful examination of the clot and injured brain tissue and of the cervical spine might have enabled the examiner to give a decisive opinion, but in the absence of such evidence it was impossible to be sure and the judge no doubt gave the benefit of the doubt to the injured party.

the shape of the contact area of the weapon; or a local starred fracture is produced, which may or may not extend beyond the area of depression.

2. **Splintering of the Tables.** In local fractures the table of the skull which at the moment of impact is adjacent to the force is splintered to a lesser extent than the table further away, owing to the fact that an absorbed force spreads and the inner table is unsupported.

This fact enables us to ascertain the direction in which a solid object has passed through the skull, the fracture of entrance having smaller dimensions, the fracture of exit having the larger, and more extensively splintered. The direction, too, in which the splinters are bent corroborates the inference.

3. If such local fractures have fissures extending from the locality, such lines will follow the rule in the next paragraph.

4. With forces of which the contact area is broader—falls on the head, crushes of cart wheels, blows of bludgeons, falls on the feet (the condyles being the points of transmission of the force) are among the more common examples—the rule is that the **line of fracture is continued along the line of direction of the crushing force**, most frequently starting from the point of contact. Thus a blow on the side of the head produces a fracture running across the base and over the vertex from side to side. Similarly an antero-posterior fracture, *either sagittal or oblique, is produced by a force acting in the sagittal or oblique plane*, as the case may be.

5. If the head be supported, and so prevented from moving, the fracture may start at the point of contact of the blow, or at the opposite point where the head was supported; for example, in falls on the vertex the fracture may have begun either at the vertex or at the base.

It is obvious the greater the violence, as in train and other smashes, the more difficult it is to trace these lines of fracture.

When the force causing the fracture has a broad area of contact it is important to remember that there may be extensive fracture and separation of the bones of the head without any laceration of the skin.

A blow on the head may produce a *fracture or displacement of the inner table* of the skull, and cause death by local compression or by effusion of blood (*vide supra*), without the whole thickness being involved.

In *R. v. Hadsen*, the prisoner struck a boy a severe blow on the head. He became sick and unconscious, fell into a state of collapse, and died the next day. On inspection the *inner* table of the skull was found to be fractured, and there was effusion of blood over the brain.

The orbits are striking but uncommon situations for direct penetrating violence. A stick, a gimlet, a pair of scissors, a birch broom, umbrella, a tobacco pipe, a penholder, have all been recorded as producing such fractures. More common are the hammer, hatchet, iron bar and spanner injuries of the vault plates. In all cases of fracture the thickness of the skull should be noted, for though it cannot, in law, ever absolve an assailant from responsibilty, the fact that the skull was unusually thin may affect the medical witness's opinion as to the severity of the violence, whether criminal or accidental.

Was the Fracture due to a Blow or to a Fall? This point has important applications in legal medicine, for there are many cases in which this is the principal matter tested in court. Injury may occur from violence with or without fracture, and it may take place without being accompanied by any external marks.

It is true that the Offences against the Person Act, 1861, uses the words: "by any other means whatsoever cause grievous bodily harm"; nevertheless, when there is evidence simply of a general scuffle, the punishment inflicted is likely to be materially influenced by the answer to the heading question above. Take the following not unusual circumstances: The deceased is annoying and following the accused; the accused turns around and pushes (he says), strikes (says the prosecution), the deceased, who falls and later dies from head injury. Although the evidence of a blow or push may be conflicting, it may be very material for the purpose of proper trial.

The answer is by no means easy, and in general the medical witness will be found in all fairness to admit that the injury was such as could well have arisen from the fall. The following points may, however, help materially to a conclusion:

1. The *nature of the area of ground* upon which the head was alleged to have fallen; soft earth, for instance, or a hard flagstone. If on soft earth, was there a sharp stone or brick or other hard substance with which the head could have come in contact?

2. *How did the fall occur—was it pitching or not?* Does the position of the injury on the head correspond with direct violence, which might have been sustained by a blow either of a fist or weapon, or does it more nearly correspond with the direction of the alleged fall?

3. The position, *number and nature of the injuries.* If a fight is admitted, many bruises may be seen, but if only one blow, or none, is admitted, then the fall may be sufficient to account for the injuries. Almost all "fall-injuries" are to the sides and back of the head.

In *R.* v. *Corio* (C.C.C., 1952) deceased was struck in the face whilst standing in a doorway: he was thrown against a projecting door handle, striking his head. He felt rough' for a bit but made his way home and got into bed partly undressed. At 2 a.m. he was heard snoring and at 6 a.m. he was found dead in his bed. Two heavy bruises, as from a fist were found on the right side of the face and an injury from a heavy blunt object on the left side of the head above the ear. The skull was depressed and fractured over an area 1 inch in diameter shaped like the surface of the door handle.

A man last seen quarrelling with a fellow workman at a gateway was later found dead on the same spot. He bore a shaped oval bruise to the side of the head and a depressed fracture that was at first thought to be the impression of the toe of a boot. It was later, however, shown to have precisely the same contour and dimensions as a corner of the ornamental wall by which he had been standing. Autopsy revealed advanced heart disease sufficient to cause collapse and fall (during which the head could have struck the wall).

In *R.* v. *Esser, Dobbs and Ransford* (C.C.C., 1942) a gang of youths assaulted a boy of 17 at the Elephant and Castle in the 'black-out'. The boy was felled to the ground and died in hospital some 2 hours later. At the autopsy a bruise 2 inches in diameter was found on the left cheek, with splitting of the upper lip over a canine tooth. These could be readily caused by a blow from the fist. Over the prominence of the back of the head there was a bruise associated with a split in the scalp probably due to a fall. The skull was fractured under this, and heavy bruising of the brain (mainly over the frontal poles), by *contre coup*, had precipitated death.

The following cases are inserted to give some warning of the gross lesions which may sometimes be inflicted without causing even the immediate unconsciousness, far less death, of the patient: —

The American Crowbar Case. Whilst engaged in blasting operations a smooth iron rod, 3 feet 7 inches long and 1¼ inches in diameter, having a tapering point and weighing 13¼ pounds, passed completely through the head of Phineas P. Gage, aged 25 years. The rod entered the skull in the temporal fossa and emerged where the two

parietal bones join the frontal bone. There was much hæmorrhage and escape of brain matter. The patient spoke a few minutes after the accident, and gave an account of how the accident happened. He had a long illness, but nine or ten weeks later he could walk, and eventually recovered all his faculties of body and mind, with the loss only of the injured eye (*viz.*, the left, which was protruded at the time of the accident).[1]

Stab Wound of the Brain.[2] A case occurred in Madras in which a man was stabbed in the forehead with a knife with such force that the entire blade, 4½ inches long, penetrated the head. The stab wound was situated above the inner end of the right eyebrow, and the blade had passed deeply into the brain; survival seemed impossible, though the man, when admitted to hospital, was talking rationally. The knife was removed only with great difficulty at the end of half an hour. After being treated for 40 days full recovery resulted.

Penetration of Brain by Iron Rod.[3] A boy aged 14 years, was running along a workshop with a long iron rod in his hand, when he tripped and fell and the rod penetrated his cheek. He pulled it out himself.

The wound was dressed by a medical man, who referred him to the infirmary for subsequent treatment; he seemed merely dazed after the accident. On the next day he presented himself at the casualty department with a septic inflamed wound in the right cheek, *and whilst waiting to be attended he seemed unable to keep awake*. This attracted the attention of the casualty officer, and the boy was admitted. Beyond a slight elevation of temperature and marked drowsiness there was an entire absence of symptoms. When roused he would sit up and answer intelligently but in an apathetic way any questions addressed to him, and as soon as they were discontinued he would drop down in bed and fall asleep at once. He would feed himself, but would go to sleep between mouthfuls. Four days later he was sent home, but a convulsion occurred and the lad died the next day.

It was found that the rod, after penetrating the cheek, had passed inside the zygomatic arch, *and through the great wing of the sphenoid. It entered the brain* near the apex of the right temporo-sphenoidal lobe and, with an inclination inwards, passed through the posterior part of the frontal lobe and ended on the convexity close to the longitudinal fissure.

This aspect of severe penetrating head injury is also referred to in the section on Firearm wounds (p. 381).

WOUNDS OF THE FACE, MOUTH AND TEETH

When wounds of the face are more than skin-deep they are potentially serious, and usually followed by disfigurement; and when they penetrate the cavities in which the organs of the senses are situated they often prove fatal, either by involving the brain and its membranes or by giving rise to inflammation of the sinuses and later of the meninges. Amaurosis or blindness is an occasional sequel of blows of the face, probably due to rupture of the retina. War has provided numerous examples of blindness without obvious external injury, but with hæmorrhage into the vitreous, ruptures of the retina and choroid, etc., to account for it. The explanation appears to be that the deep injury is due to compression of the eyeball by force of explosions or blows on the face.

Wounds of the nose are, generally speaking, of a simple nature, capable of dangerous bleeding into the throat and bronchial tree, but rarely otherwise giving rise to serious symptoms. They are often followed by deformity. If the injury is a contusion and, at the same time, extensive, a loss of the sense of smell may result. A penetrating wound of the nose, produced by passing a sharp-pointed instrument up the nostrils, may destroy life by perforating the cribriform plate of the ethmoid bone and injuring the brain.

[1]Bigelow, A. J. 1850. *Amer. J. med. Sci.*, 20, 2.
[2]Copeland, A. J. and Nolton, H. 1925. *Brit. med. J.* 2, 540.
[3]Knaggs, R. L., 1907. *Lancet* 1, 1477.

Such a wound, it is obvious, might be produced without leaving any external marks of injury. Infection of the meninges may follow, either rapidly or after remarkably long intervals[1].

INJURIES TO THE SPINE

Injuries to the spine and spinal marrow seldom involve criminal enquiry, but they are very common in civil cases, both under the older Workman's Compensation and the National Insurance (Industrial Injuries) Acts. The spinal cord is liable to *concussion* from blows, to compression from dislocation or fracture of the vertebræ, or to the effusion of blood, with all the secondary consequences attending such events. Concussion of the spinal cord commonly produces transient paralysis, affecting the bladder, rectum, or lower extremities. These symptoms may not appear at once, but come on after some hours. It is not uncommon to have a momentary dislocation of the spine, especially in the cervical region, causing crushing of the cord followed by immediate restitution. In such circumstances the person may die suddenly or may survive with clinical signs of nerve injury, depending on the site of the temporary dislocation. Many cases of cord injury are no doubt due to such luxations or displacements, causing contusion of the cord or its nerve roots. Autopsy examination of the cord may show an area of hæmorrhagic discolloration on the surface or in the substance of the cord, or there may be subthecal effusions of blood. Blows on the spine unattended with fracture or dislocation, may be followed by œdema and softening of the cord, and in certain cases the pathological effects of an injury may not show themselves for some time after. X-ray may not reveal the injury, for the dislocation may, after damaging the cord, be self-reducing.

A man recovering from influenza staggered weakly into a pillar-box, striking his brow and throwing his head back, dislocating (as autopsy later showed) the cervical spine. He could not stand and was dazed and incoherent. He was taken in charge as drunk and incoherent.

A man was tried on a charge of manslaughter. It appeared in evidence that he had thrown the deceased on the ground, and while he was attempting to rise he caught him by the throat, forced him backwards, and brought his head violently in contact with the ground. The deceased died after a few convulsive gasps. At autopsy the spinal cord was found to be compressed between the body of the fourth and the arch of the third cervical vertebra. On removing it no indentation or laceration of its substance was perceptible. Death had ensued from paralysis.

Such cases show the necessity for inspecting the vertebral column when death is alleged to have been caused by violence, and no traces of it are perceptible in other parts of the body. Indeed, it is not improbable that in many cases of death from alleged or suspected violence, where the cause is obscure, if the spinal cord were examined, the fatal result might be explained by the discovery of some mechanical injury or morbid change in this organ. This part of a medico-legal inspection is too commonly neglected.[2]

Fractures of the Vertebræ. These fractures —of which some 25 per cent occur between C3–5 and another quarter between D12 and L2 are generally[3] attended by displacement, and thus produce compression of the spinal cord. If the level of compression is above the fourth cervical segment death is

[1] Boggart, J. H., 1936. *Pathology of the Nervous System*. Baltimore: Wm. Wood.
[2] Walshe, F. M. R., 1944. *Lancet*, 2, 173.
[3] Moritz, A. R., 1954. *The Pathology of Trauma*. London, Henry Kimpton.
[4] Simpson, K., 1953. *Forensic Medicine*. 2nd Ed. London: Arnold.

usually immediate, asphyxia resulting from paralysis of the nerves which control respiration. It used to be said that in falls on the top of the head from a height, it happens not only that the skull is extensively fractured, but that the odontoid process of the second vertebra is broken off, owing to the head being doubled under the body. This is exceptionally rare. It may happen that caries of the bone, or disease of the transverse ligament, may cause a separation of the odontoid process from the second cervical vertebra. The state of the bone in an alleged fatal accident should therefore be closely examined. In *R. v. Reid* an acquittal took place, partly because the deceased had suffered from disease of the spine prior to fracture, and the exact state of the parts had not been noticed. A slight cause (*vide supra*) may sometimes produce severe and fatal injury to the neck.

In judicial hanging, where the point of suspension lies a little in front of the angle of the jaw, there is both tilting of the head and sudden elongation of the cervical spine. The latter usually gives way between C3 and 4 and the cervical cord is torn away at its junction with the medulla. The result of the latter is instant death.

In *R. v. Cope* (C.C.C., 1915) accused was sentenced to 18 months imprisonment for an assault which dislocated his victim's neck. He struck a blow with the fist to the jaw, felling the man across a bed. The man lay paralysed—and accused left him. Children found him later—"unable to get up". He had dislocated C3/4 and 4/5, crushing the cord.

A woman died suddenly a month after her confinement; she had been suckling her child at one o'clock in the morning, and at four she was found dead. The viscera were carefully examined without the discovery of any morbid appearance to account for her death, when, as the brain was being returned into the skull, one of the doctors noticed a projection at the foramen magnum. On further examination the dens of the second vertebra was found to have been displaced, and this had so injured the spinal cord as to cause death. The cause remained obscure.

Much more common are the subluxations, fracture dislocations and compression fractures at other levels, notably C2–5, D3–6, D10–L3.

A man died suddenly while holding his head in a butting position during a struggle with a friend. The friend had forcibly rotated or twisted the deceased's head a few times from side to side by the brim of his hat. On inspection it was found that the first four cervical vertebræ were fractured—the ligaments were bruised and torn, and blood was effused on the coverings of the spinal cord.

Compression of the spinal cord sometimes arises, though rarely, from *effusion* of blood from a fall. It is important to remember that an effusion of blood, or pus and caseous deposits, may also take place from disease.

Injuries to the spine and its contents are generally the result of pitching or diving falls or of blows either on the brow or chin, or by compression of part of the column, or of buckling under heavy weights, as in navvies and housebreakers, etc. The secondary consequences of these injuries are sometimes so insidious as to disarm suspicion, and death may take place from embolism, pneumonia or urinary infection weeks or months after the accident.

The spinal cord is occasionally wounded in its upper part by sharp-pointed instruments introduced between the vertebræ. Death is sometimes an instantaneous result when the wound is above the third cervical vertebra; there is no part of the spine where a weapon can so easily penetrate as this, especially if the neck be slightly bent forward. The external wound thus made may be very small, and if produced with any obliquity by drawing aside the integuments, it might be easily overlooked, or it might be considered superficial.

In fractures of the vertebræ, a person is generally so disabled, whatever may be the situation of the fracture, that he cannot walk or exert himself. We must be prepared, however, for exceptions to this. The cord is significantly injured in only about one half of all the spine fractures.

A man, *æt* 35, was admitted into the Northampton Infirmary suffering from paralysis of the legs and great pain in the back and in the abdomen. He could give no intelligible account of the cause of his illness. He soon died; and on a *post-mortem* examination the tenth dorsal vertebra was found broken in its body and arch. There was slight displacement, but it was not such as to press upon the spinal cord. A large clot of blood was situated on the sheath of the cord, and had caused the paralysis. It was proved at the inquest that deceased met with a heavy fall, but that he had walked some distance afterwards, visited several public-houses, gone home intoxicated, and laid down to sleep in a yard. He awoke in the morning sober, but was unable to move his legs. There is no doubt that the effusion of blood was the cause of the paralysis, and this did not occur until some time after the fracture, as the result of slow oozing.

Further remarks on spinal injuries will be found under "Drowning".

WOUNDS OF THE CHEST, LUNGS, HEART AND OF THE GREAT VESSELS

Wounds of the chest have been divided into those which are "closed" or "non-penetrating", i.e., do not open up any part of the thoracic cavity, indeed may be confined to the walls, and those called "open" which penetrate the cavity. Wounds confined to the chest-wall are rarely followed by dangerous consequences. Bleeding is not considerable, and is generally arrested without much difficulty; unless their effects are aggravated by incidental circumstances, the person recovers. Heavier contused wounds of the chest are, however, far more dangerous, and the danger is in a ratio to the degree of violence used. Such injuries when severe or of "pincer" form are ordinarily accompanied by fractures of the ribs or sternum; by a rupture of the viscera within the cavity, including the diaphragm; by contusion or other damage to the lungs or heart; by profuse bleeding; or, as an after-effect, by inflammation of the lungs with or without suppuration.[1] Fractures of the ribs are dangerous for the bones may be splintered and driven inwards, wounding the lungs or heart and causing hæmorrhage and pneumothorax or leading to inflammation of the pleura or lungs. In fractures of the upper ribs the prognosis is less favourable than in those of the lower, because commonly a much greater degree of violence is required to produce the fracture. A simple fracture of the sternum or chest-bone without displacement of the bone is rarely attended with danger, unless the concussion has at the same time produced damage internally, but if the bone is depressed as well as fractured, the viscera behind may be seriously injured; immediate and severe; symptoms are likely to attend such deeper injuries. In cases where the victim is "impaled" on a steering wheel, the aorta may be ruptured.

In one case of depressed fracture of the sternum, the patient died after the lapse of 15 days; and on inspection it was found that the fractured portion of bone had produced a transverse wound of the heart about an inch in length. The cavities of the organ had not been penetrated, but the piece of bone was exactly comparable with the injury caused to the heart.

In a 'smash and grab' raid a stolen car was driven away at a high speed. Accelerating round a sharp bend to elude pursuit the car mounted the pavement and collided with a lamp standard, becoming a total wreck. The driver and near front passenger

[1] Osborn, G. R., 1943. *Lancet*, 2, 277.

both received fatal injuries. The steering wheel was bent forward some 50° in its lower half, and autopsy on the driver revealed a buckled sternum (with fractured ribs) and lacerated aorta; the arch: the tissues were not diseased at the site of the split—an almost complete annular tear at the end of the arch.

Wounds penetrating into the cavity of the chest are generally dangerous, even when slight, in consequence of the numerous complications by which they are so liable to be followed. In these wounds, the lungs are most commonly injured, but according to the direction of the weapon, the heart or the great vessels connected with it, as well as the œsophagus and the diaphragm, may share in the damage. Penetrating wounds from external sources are much more prone to septic infection than wounds caused by the broken ends of ribs or sternum. The details of "complicated" closed and "penetrating" chest wounds will now be discussed at greater length.

Wounds of the Lungs

The immediate cause of danger from wounds of these organs is the consequent hæmorrhage, which is usually profuse in proportion to the size of the wound. Should the weapon divide any of the trunks or main branches of the pulmonary vessels, the individual may speedily die. The degree of hæmorrhage cannot be determined by the quantity of blood which escapes from the wound, for it may flow internally and collect within the cavity of the pleura. This is especially likely when the external orifice of the wound is small and oblique, and one of the intercostal arteries has been cut or torn by the weapon. A wound of the lung is generally obvious from the frothiness and florid colour of the blood, which issues from the orifice, as well as by the coughing of blood. Buckling injuries or compression of the chest may cause bruising of the lung, laceration of its substance, or considerable ruptures with or without external evidence of violence.

The detonation of high explosives causes "blast effects" in the lungs which are characterized by the presence of hæmorrhages into the lung tissue, intense capillary congestion, distention and rupture of vesicles.[1][2] These are produced by the waves of compression and de-compression which strikes the body with considerable violence. Hæmorrhages and lacerations are also found in the abdominal viscera, in the central nervous system and in the *muscles*. The *suction effect* of the wave of low pressure following the blast is said to be a likely secondary agent in the production of these injuries.[3] Blast is merely a severe and swiftly acting external trauma.[4][5] The lungs may sustain serious injury from a blow or fall, and yet there may be no external marks of violence, and symptoms indicative of danger may not develop for some hours.

A young man while riding his horse fell on his left arm. He did not complain of pain for five hours, but in 12 hours he was seized with an alarming flow of blood from the mouth. He died in the course of a few hours. After death there was no external mark of injury to the chest, but the right lung was ruptured posteriorly and much blood had been effused.

A boy, aged 14, fell to the ground from a height of about 20 feet, and died about three hours later. On examination of the body there was no mark of external injury. The collar-bone was fractured, but the ribs had escaped injury. The right lung was

[1] Hadfield, G., and Christie, R. 1941, *Brit. med. J.*, 1, 77.
[2] Ross, J., 1941. *Brit. med. J.*, 1, 79.
[3] Moritz, A. R., 1954. The Pathology of Trauma. London, Henry Kimpton.
[4] Tunbridge, R. E., and Wilson, J. V., 1943. *Quart. J. Med.*, 36, 169.
[5] Cohen, H., and Biskind, G. R., 1946. *Arch. Path.*, 42, 12.

ruptured to the depth of 4 inches into its substance, and from this rupture a large quantity of blood had escaped into the pleural cavity.

A doctor should remember that death, when it occurs during the convalescence of a person who has survived the first effects of a penetrating wound of the chest, may well have been caused either by imprudence on the part of the patient or by ignoring advice, or other stupidity; for circumstances of this nature may be occasionally treated as mitigatory on the trial of the assailant.

A soldier died instantaneously from internal hæmorrhage, brought on by throwing a bowl at some nine-pins, two months after he had been apparently cured of a wound of the lungs. This giving way of an old healed wound is a well-known occasional accident in any region of the body that can be subjected to a strain.

Death in injuries to the lungs may ensue quickly as a result of hæmothorax or inhalation of blood into the bronchial tree. Complications such as pneumothorax, traumatic emphysema, air embolism, or. after a period, pleurisy, empyema, lung abscess or pneumonia, are matters of more clinical nature.

Wounds of the Heart

Non-penetrating Heart Injury. Contusions of the heart are not uncommon in cases where the chest is compressed or the sternum fractured. The heart may be pinned between the sternum and the spine or suffer local injury by fractured bone (*vide* rupture of heart infra). Heavy pinning or crushing under machinery or masonry, pinning whilst standing between moving vehicles and some "fixing" mass such as another stationary vehicle, and crushing impacts upon the steering wheel by the driver of a car in "head-on" collisions are the commoner causes. The heavier the weight or violence of impact the more likely is the heart to sustain rupture—most commonly across the R. auricle, L. ventricle, R. ventricle, L. auricle in this order of decreasing frequency.

Bruising of the heart is not uncommon in far less violent incidents, often without evidence of trauma.[1] Electrocardiography[2] has shown how "commotio cordis" and functional upsets like auricular fibrillation and coronary artery spasm may ensue. Functional upsets of the heart's action is often attributed to such trauma and cases of this nature must be assessed with great caution.

In the following case[3] little doubt could exist as to the traumatic nature of the heart lesion.

An artillery officer aged 36 years, fit and well, was struck in the chest by the "perch-handle" of a 25-pounder gun. He momentarily lost consciousness and complained, on recovery, of pain in the chest. He experienced a sense of "constriction" in climbing a hill and proved unable to exert himself. Several more violent anginal attacks occurred in the following 16 months and E.C.G. tracings showed right bundle branch block.

Cases must plainly be judged individually and by a combined assessment of (*a*) the relationship in time between injury and the onset of symptoms and (*b*) the detection of E.C.G. changes not previously recorded. It is a matter of probabilities rather than of scientific proof, like so many other assessments of the relationship between trauma and disease.

[1] Reed, L. K., and Berger, K. E., 1945. *Amer. Heart. J.*, 30, 622.
[2] Warburg, E., 1950. *Brit. Heart J.*, 2, 271.
[3] Vakil, R. J., and Lenezner, M., 1951. *Brit. med. J.*, 2, 1120.

Penetrating Wounds of the heart are among the most fatal of all *wounds of the chest.* It was formerly considered that all wounds of this organ were necessarily and instantly fatal, a view which has long since been considerably modified, for some survive and many cases have been operated upon with complete success. When the wound is small and the weapon penetrates into the cavities of the heart obliquely, life may be prolonged for a considerable period, and numerous cases are on record in which such wounds have healed, or the patients have recovered as a consequence of immediate surgical repair.

Dupuytren reported the case of a man who received a stab on the left side of the chest. The symptoms under which he laboured did not lead to the suspicion that he received a wound of the heart. The man died in eight days, of *cerebral disease,* possibly an embolism. At autopsy it was found that the left ventricle was wounded about the middle and a little to the right, its cavity having been penetrated in a transverse direction. The external fibres were most separated: the openings diminished gradually, so that the internal fibres were in contact and closed the wound.

A boy, in pulling a knife from a companion with the point towards him, accidentally stabbed himself in the chest. A small quantity of blood escaped; he vomited, and fell to the ground. He died eight days later. The left ventricle had been perforated, and 24 fluid ounces of blood was found effused in the chest. Fatal hæmorrhage is not always immediately so.

In another instance, reported by Dupuytren, five or six wounds were made by means of a saddler's needle, most of them penetrating into the left ventricle of the heart. The man died of a *cerebral lesion* 25 days after the wounds could have been possibly inflicted; for the needle was taken from him 25 days before his death, without any suspicion being entertained of his having wounded himself with it. The punctures were visible on an inspection of the body. Such *cerebral lesions* are almost certainly due to emboli of mural clot.

From a series of cases collected by Ollivier and Sansom it appears that out of 29 instances of penetrating wounds of the heart only two proved fatal within 48 hours. In the others death took place at the varied periods of from *four to twenty-eight days after the infliction of the wound.* These differences *in* the time at which death occurs, as well as the fact that wounds of the heart do not immediately cause death, have been ascribed to the peculiar disposition of the muscular fibres of the organ, and to the manner in which they are penetrated by a weapon. Thus, as a general principle, wounds which are parallel to the axis of the heart are, *cæteris paribus,* less rapidly fatal than those which are transverse to its axis. In a wound which divides the fibres transversely, the opening will be larger, and the hæmorrhage greater, than in one that is parallel to these fibres; and as the heart is composed of different layers of which the fibres pass in different directions, so in a penetrating wound of its cavities, while one set tends to separate the edges, another tends to bring them together, and thereby to restrain the flow of blood. It is this action of the fibres which renders wounds of the ventricles less rapidly fatal than those of the auricles, other circumstances being equal.

A man has been known to survive a laceration of the left auricle 11 hours. In this case the chest was crushed, and after death it was found that the left auricle was lacerated to the extent of an inch; nevertheless this patient survived the injury for the long period mentioned. In another instance, where a man was stabbed through the left auricle during a quarrel, death did not take place until after a lapse of 78 hours.

The presence of a weapon in the wound, by mechanically obstructing the effusion of the blood, also retards the fatal result.

A lunatic wounded himself in the left side of the chest. Two days afterwards he was admitted into hospital. The wounded man stated that he had plunged the

instrument into his chest, and had not been able to withdraw it. His symptoms became more aggravated, and he died on the 20th day after the infliction of the wound. The pericardium and the surrounding parts were found inflamed. After opening the heart an iron stiletto was discovered, firmly embedded in the substance of the left ventricle, which it had entirely traversed, so that its point projected slightly into the cavity of the right ventricle.

Two cases have been published in which projectiles were found embedded in the wall of the left ventricle, 11 years after the injury. In both cases the men were leading active lives.[1]

It appears that the right cavities of the heart are more frequently wounded than the left, and of these the right ventricle is most commonly the seat of injury. Out of 54 cases of wounds of this organ, 29 were situated in the right ventricle, 12 in the left ventricle, nine in the two ventricles, three in the right auricle, and one in the left auricle. These differences are readily accounted for by the relative situations of the cavities. It is considered that the rapidity of death in severe wounds of the cavities of this organ is to be ascribed not merely to the loss of blood, but to the embarrassment which the heart action experiences from fluid accumulating in the pericardial sac. In reference to the *direction* of penetrating wounds of the chest it may be stated that the base of the heart corresponds to the upper margin of the third rib of the left side and the apex to the lower margin of the fifth rib on the same side.

Ruptures of the Heart.   The heart is liable to *rupture* either from disease or accident. In ruptures from natural causes it is in the left side of the heart, usually through infarcts of the left ventricle, that rupture is most frequently found. The symptoms are sudden pain, collapse, cold extremities, and rapid death. According to the circumstances in which they occur, cases of rupture from disease may create a suspicion of death from violence.

A woman was found dead in her bath, face down, in Welwyn Garden City. Suspicion had been aroused by her husband's account of their relationship and by doubt as to the veracity of his story that he had found her so on his return from London at the end of a day's work; a tradesman had obtained no reply to a call before midday. The bath had become cold and there was no sign of a struggle: a minor bruise on the brow was such as might have followed collapse on to the face whilst on the knees in the bath. Autopsy provided the answer to the problem: an infarct of two to three days duration was found freshly ruptured, causing a fatal haemopericardium.

When the heart is ruptured by compression or from a blow or a fall it is not always accompanied by marks of external violence, or any fracture or other injury to the exterior of the chest. The common sites of rupture by trauma are the R. auricle, L. ventricle, R. ventricle, L. auricle, ventricular septum and valves in this order of diminishing frequency.

Moritz considers that contusion does not lead to residual cardiac disability if the initial effect is recovered from, but this depends on the extent of the damage to the heart muscles.[2]

A man of 46, standing at the rear of a lorry beckoning it on, was suddenly pinned by the tail board against a loading platform, and held there for several seconds. As the lorry ran forward again he fell to the ground: he did not move, and was plainly dead. The right auricle and base of the right ventricle were extensively ruptured by pinning between ribs and spine.

Christison met with two similar instances, one caused by a fall, the other by a blow. A child was killed, as was supposed, by the wheel of a carriage going over its chest. On inspection the skin, muscles and ribs were free from any marks of injury. The

[1] Gilchrist, A. R., 1929, *Brit. med. J.*, 1, 723.
[2] Moritz, A. R., 1954, The Pathology of Trauma. 2nd Ed., p. 167. London: Henry Kimpton.

pericardium was lacerated, and a pint of blood was effused into the right pleural cavity. The heart was found ruptured throughout its entire length. In another case, a man fell 100 feet from a cliff. There were a few slight bruises about the body, but no serious wound or fracture. On opening the chest the pericardium was found to be distended with dark fluid blood, which had escaped from an irregular opening about three-quarters of an inch in diameter, situated in the anterior portion of the right auricle.

A boy was run over by a heavy waggon, two wheels of which passed over his chest. He got up apparently not much injured, but on reaching the side of the street fell dead. On dissection, the heart was found ruptured. The ribs were not fractured, nor was there any laceration of the walls of the chest.

The only *natural* cause of rupture of the heart is softening or thinning by infarction, but violent emotional disturbances such as anger, fright, paroxysms of passion, sudden muscular efforts, or violent physical exertions in constrained positions—in short, any conditions associated with increased blood pressure and extra strain can precipitate such a rupture of unhealthy muscle. The healthy heart does not rupture.

Rupture of the heart may prove suddenly and rapidly fatal, even although the lesion may not involve the cavities. Bleeding from the surface may fill the pericardial sac with fatal consequences.

Death from the Entrance of Air into the Wounded Veins

In operative and other[1] wounds there is an occasional and somewhat unusual cause of death which requires mention, namely, the entrance of air into the divided vessel and "air-locking" embolism of the circulation.

Air gains access to the blood through a wound in a vein owing to the fact that during inspiration and certain phases of the heart's cycle there is a negative pressure in the veins: it is common in cut throat, in wounds and operations at the root of the neck or in the chest, and, less frequently in the abdomen and pelvis. See also air embolism in "Abortion". (Vol. II).

Wounds and Ruptures of the Diaphragm

The diaphragm, a muscular partition between the chest and abdomen, is liable to be wounded either by weapons which penetrate the cavity of the chest or abdomen, or by the ribs when fractured by violent blows or falls; but, in any circumstances, wounds of this muscle are not likely to occur without involving the important organs that are in contact with it. It is scarcely possible, therefore, to estimate the abstract danger of these injuries, which must materially depend on the degree of involvement of the adjoining viscera.

Slight penetrating wounds of the diaphragm may heal, like those of other muscular parts; many such cases are on record. There is, however, a consecutive source of mischief which no remedial means can avert—namely, the formation of a diaphragmatic hernia. Heavy pressure on the abdominal viscera may cause the diaphragm to yield, and stomach or bowel may then penetrate into the pleural cavity. Strangulation by the walls of the aperture *is not common*, though some degree of obstruction is.

In a case of this description, when death occurs at a long period after the infliction of the wound, the witness may be required to say whether the wound was the cause of death, or whether there were any other circumstances which would have caused or facilitated the production of a hernia. The liability of a defendant may materially depend upon the answers returned to

[1] *Simpson, K.*, 1942. *Lancet*, I, 697.

these questions; as this form of internal rupture is not by any means an unusual or unexpected fatal consequence of a wound of the diaphragm, it would appear, at first sight, that death, at whatever period this event may occur, should be referred to the original wound. But a person may survive with a large phrenic hernia for a considerable period and die from some other cause. A case of this kind has already been related in which the stomach and part of the intestines were found in the left cavity of the chest, and the person lived for nine months.

Cases like the following,[1] where a man lived for five months with a large arrow-head fixed in his abdomen after injury to important organs and recovered from the operation for its removal, must necessarily be infrequent.

The patient, a young Marwat Pathan, was admitted to hospital on October 27th, 1923, for abdominal pain. The history of the case was that, 'five months previously, he had been shot in the eighth right intercostal space in the anterior axillary line with a steel-headed arrow. At the time he grasped the shaft and extracted it, and was carried to his village, where he remained for about four weeks ill. After this time he got up and went about as usual, except for attacks of vague abdominal pain, which were aggravated by taking food. A month previous to admission he noticed a swelling, which had been tender, in the left epigastric region, and consulted the nearest Government dispensary, whence he was referred to hospital, a journey of some 22 miles by camel.

On admission a swelling about 1½ inches by 1 inch was seen in the left epigastric region, opposite the tip of the ninth left costal cartilage, and ¾ inch from the costal margin.

During the night of October 27th–28th, 1923, the patient "felt something move inside him," and next morning complained of a severe gnawing pain 1 inch below the left nipple.

An exploration was performed, with the reddened swelling as its centre, and deepened at that point in order to localize any collection of pus that might exist. None was found, however, the swelling consisting of partially organized granulation tissue, and the abdomen was opened along the length of the incision. On exploring with the hand the arrow-head could be felt high up in the left hypochondrium, pointing downwards, forwards, and to the right, moving markedly with respiration.

The haft of the arrow-head (6¼ inches long) was found in the fundus of the stomach, grasped with Mayo-Ochsner forceps, and pulled out, and the stomach cavity investigated.

The position of the entrance wound and the situation in which the weapon was discovered would seem definitely to establish the injury of the following structures: (1) the right pleural cavity, (2) the right dome of the diaphragm, (3) the liver, and (4) the stomach.

Convalescence was uninterrupted and the patient left hospital cured, and on full diet, on the 21st day after operation.

The most serious injuries to the diaphragm are unquestionably those which are produced by violent contusions or falls on the abdomen at a time when the stomach and intestines are distended. On these occasions the muscular fibres may be ruptured, slight loss of blood ensuing. A uniform result of such ruptures, when extensive, is a protrusion of the stomach into the chest, with occasional rupture of the coats of that organ and extravasation of its contents. Severe lacerations of the diaphragm are more readily produced during the act of inspiration than during expiration, the fibres of the muscle being then firmly contracted and receiving, while in this state of tension, the whole of the force. Besides the stomach, it sometimes happens that the liver, spleen, or intestines pass through the opening, and these organs are then liable to become strangulated; respiration is embarrassed, and fatal anoxic changes may result.

Such immediate protrusions of viscera into the chest should not properly be called diaphragmatic herniæ. It is better to reserve that term for the established sac ... not uncommonly a developmental lesion associated with a "short œsophagus".

WOUNDS OF THE ABDOMEN AND ITS CONTENTS

Incised and punctured wounds, which affect the walls of the abdomen without penetrating the cavity, are not specially dangerous except on account of their proximity to the peritoneum and the dangers of conveying an inflammation to this cavity.

The walls of the abdomen are easily penetrated by pointed instruments, and it requires but a slight force to wound the peritoneum or the intestines. A slight wound may thus prove fatal owing to escape of bowel contents.

But when these wounds take a favourable course and heal, there is a possible complication, namely, a protrusion of the viscera at the scar, constituting **ventral hernia**. When the wound has involved the muscular fibres transversely to their course, the cicatrix which follows is commonly far less capable of resisting the pressure of the viscera within than other parts of the parietes. A hernia may take place, and this, like other herniæ, if neglected, is liable to become strangulated and lead to death.

Penetrating wounds are not always fatal, even when such a result might be expected. A very large number of bullet wounds have apparently done no damage to viscera. One of the authors saw an abdomen transfixed from behind forwards by a long Eastern sword without visceral injury.

A soldier by accident so fell upon his bayonet that, although the weapon traversed the whole cavity of the abdomen (entering at the back and coming out in front below the navel), the man recovered in about six weeks. This case is of importance in reference to the situation and direction of wounds. Had there been no knowledge of the facts, this accidental wound might have been pronounced homicidal.

Contusions of the walls of the abdomen are more difficult and liable to more obscure effects than are those of the chest. This arises from the coverings of the abdomen reflecting little of the real damage arising from external violence. Death may be the immediate result of a blow in the upper and central portions of the abdomen, even when no marks of violence lie on the skin or viscera. Death has been ascribed in these cases to shock from the effect of the violence on the nerve plexuses of the abdomen. Some remarks have already been made on sudden death from blows on this part of the abdomen. Cases of this kind are of not infrequent occurrence, and, in the absence of marks of physical injury in the part struck, a jury might be led to doubt whether the blow could have been the cause of death.

In *R.* v. *Jones* the prisoner was charged with having struck the deceased several blows on the breast and one on the pit of the stomach, upon which he immediately fell down senseless and expired. No morbid appearances were found. The prisoner was convicted of manslaughter. In another case death was thus caused by violence during a boxing match. A man received a blow in the stomach, and fell dead. In a similar case the deceased, a powerful man, received during a boxing match a blow on the abdomen, and he immediately fell backwards dead. On an examination of the body, there were no marks of injury, either externally or internally. Death was attributed to sudden shock. The judge left it to the jury to say whether they thought the death was caused by a blow; but if they could not say what was the cause of death, or if they should think that death was attributable to excitement, and that it was independent of the blow, the prisoner would be entitled to an acquittal. A verdict of not guilty was returned.

A review of vagal reflex inhibition as a cause of sudden death was given by Simpson in 1953.[1] The most careful inspection may fail to reveal visible changes in the organic structures; persons have died soon after having received a severe blow on the upper part of the abdomen, or in the scrotum, and examination of the body may not reveal any physical injury, or any condition which could have caused sudden death. The process is a disturbance of function.

A blow on the abdomen, when it does not cause death by shock, may cause death by setting up peritonitis, which may extend to other serous membranes (*vide infra*).

Abdominal injuries are not always accompanied by a visible bruise or injury to the skin and, indeed, it must be remarked that when muscle or fascial tearing is found without injury to the skin it may possibly have been produced by violent muscular action as in the convulsions of tetanus or in trying to escape a blow, not by the blow itself. It is occasionally seen, too, as the result of anoxia or muscle disease—typhoid fever, for example—and might in such circumstances possibly give rise to suspicion of violence.[2]

It is, after all, by damage done to the underlying viscera that blows on, and wounds of, the abdomen have their real dangers estimated, and it must again be emphasized that the most extensive internal damage may show no external bruising of the skin. Clothing pressure marks in the livid stains sometimes indicate sites of maintained pressure.

Laceration of the Liver. Rupture of the liver is most commonly the result of impacts or crushing, motor accidents and of similar accidents in industry. It may result from blows in the back, the side or on the abdomen, by falls on the abdomen, in rare instances by a sudden action of the abdominal muscles. Ruptures of the liver, though generally seen on the convex surface and anterior margin, may only involve the deep substance of the organ, consisting of bloody fissures. The right lobe, from its size, is five times[3] more commonly affected than the left. But little blood occupies the laceration itself; it is commonly found effused in the lower part of the cavity of the peritoneum, or in the pelvis. The bleeding, should large portal veins or the vena cava be implicated, is sufficient to cause rapid death; but in other circumstances a person may survive some hours, as the blood may escape only slowly, or it may suddenly be effused in fatal quantity after some hours or days as a result of violent exertion or of fresh violence applied to the abdomen.

A man went to hospital but was found to have no immediate or urgent symptoms. He was sent away, and a few hours afterwards was found dead in a cell at a police-station. On inspection the liver was lacerated, and copious blood was found in the cavity of the abdomen. This effusion must have taken place after the man had left the hospital.

A man, who had been in good health half an hour before, was found dead upon the high-road, and there was reason to believe that he had been run over by his own dray. The abdomen was found full of effused blood from a large rupture on the under-surface of the right lobe of the liver. The diaphragm was ruptured, and the liver protruded through into the chest. *There were no marks of external violence.* The sixth and seventh ribs were broken transversely near their anterior extremities. It was thought probable that the man had fallen under the wheel of the dray.

Ruptures of the liver, if fatal, generally cause death within 48 hours, but

[1] Simpson, K., 1953. Modern Trends in Forensic Medicine. London: Butterworth.
[2] Cullen, T. S., 1937. *Bull. Johns Hopk. Hosp.*, 61, 312.
[3] Moritz, A. R., 1954. The Pathology of Trauma. 2nd. Ed., London, Henry Kimpton.

Taylor reported a case in which a patient in Guy's Hospital survived this accident ten days. On inspection it was found that the diaphragm had been ruptured as well as the liver, and that the two had united, an abscess having been formed between them. The liver had been lacerated on its right side.

In another case in which the patient survived ten days, death took place from internal hæmorrhage. On inspection there was a rupture of the right border, involving the entire thickness of the liver. It arose from a fall from a third-storey window. There were no external marks of injury.

In *R. v. Caffery* the question was raised in reference to these ruptures as to the time required for the effusion of a large quantity of blood into the abdomen when none of the large vessels is involved in the laceration.

A police-constable was charged with having caused the death of a man. The deceased was drunk, had fallen three times, and had been kicked and maltreated by a mob. The accused took or dragged him to the station, and during an attempt to escape he knocked down the deceased and fell on him, his knee striking the abdomen. The deceased appeared to suffer great pain when he was lifted up, but he was able to walk to the station with assistance; when there he soon became insensible, breathed heavily, and died 15 or 20 minutes afterwards. On inspection the liver was found to be ruptured in three places, but none of the large blood vessels was involved. Some three pints of blood were effused in the abdomen, and the medical witnesses agreed that death was due to internal hæmorrhage as a result of the ruptures. The question, however, arose whether the ruptures were caused by the violence of the prisoner about 20 minutes before death, or by any of the falls and ill-treatment which had occurred previously.

For the defence it was suggested that so large a quantity of blood could not be effused in so short a period as a quarter of an hour or 20 minutes, inasmuch as the rupture involved only the substance of the liver, and not the large blood vessels. The accused was acquitted.

The question here raised was based on speculation, and it is not surprising that the witnesses differed. The violence received before the accused took the deceased into custody was admitted to have been quite sufficient to account for the ruptures of the liver and the fatal hæmorrhage, and there was nothing by which it could be accurately timed. We have no means of measuring the rapidity with which blood flows on these occasions. It is stated that the liver was ruptured in three places; hence an extensive bleeding surface must have been exposed. The man was able to walk before the violence; and this exertion may have added to the hæmorrhage. Some bleeding would probably continue after death so long as the blood retained its fluidity. The accused was acquitted, not because the amount of effusion was inconsistent with the time assigned, but because the evidence did not prove that his violence caused the rupture. Assuming that the rupture existed when the deceased was struck by the accused, it might have been a question whether his violence had accelerated death by increasing the hæmorrhage.

Certain pathological states of the liver render it more friable and therefore liable to be ruptured with minor degrees of violence, for example in states of swelling by congestion and in fatty softening.

Wounds of the Gall-bladder. Wounds and ruptures of the gall-bladder are attended by an effusion of bile. This irritating fluid finds its way into the cavity of the abdomen, and the person may die from peritonitis. In a fatal case of this description, an old man, while getting out of bed, fell with great violence on the floor. He died from peritonitis 48 hours later. The gall-bladder was ruptured, a large stone impacted in the cystic duct had caused it to dilate and thus to become more liable to rupture: such cases are rare.[1]

[1] Norgrove, M., 1946. *Ann. Surg.*, **123**, 127.

Ruptures of the Spleen. Ruptures of the spleen may occur either from violence or disease, and it would appear from the following case that a slight degree of violence is sufficient to rupture this organ, while there may be no marks of injury externally.

A middle-aged man was observed fighting with a boy about 14 years of age, who in stature scarcely reached to his waist. When the fight had terminated the boy ran away; the deceased was observed to become weak and faint, and he complained of uneasiness in his left side. He expired a few minutes afterwards. On inspection no marks of violence could be detected externally; but the cavity of the abdomen contained a large quantity of blood. The spleen was found enlarged, and so softened that its structure was broken down by the slightest pressure. There was a laceration across its surface, about half an inch in depth from which the fatal bleeding had occurred: there was no mark externally to indicate that a blow had been struck in this region.

A little girl died in 14 hours from rupture of the spleen. The rupture had been caused by the wheel of a cart passing over her body. There was no mark of external violence. It is highly probable that, when the spleen is ruptured from slight causes, the structure of the organ will be found to be in a diseased condition—a circumstance which might in some cases be regarded as mitigatory both in civil and in criminal litigation.

A man, aged 24, fell from a masthead, 25 feet in height, and it was thought that he had fallen on his back. He was rowed ashore, and walked to the hospital, where he arrived about an hour after the accident. He died in a quarter of an hour, apparently from internal hæmorrhage. On inspection there were no external signs of injury. The abdomen contained several pints of blood. The spleen was torn transversely through its middle, and the splenic vein was lacerated in a longitudinal direction. This organ was about twice its natural size, soft and had the appearance of a malarial spleen. The exertion of walking probably accelerated death.

Cases of spontaneous rupture of the spleen are reported from time to time,[1] but it is extremely doubtful if a normal spleen ever ruptures spontaneously. When the spleen is the seat of disease as, for example, in malaria particularly, but also in Banti's disease, in Kala Azar, in leukæmia, etc., it is liable to rupture with comparatively little violence. In some cases the trauma may not lead to rupture of the capsule and consequently a hæmatoma develops in the organ which may rupture the capsule and produce serious symptoms only after several days. In one recorded case no complaint was made for 36 hours after the injury.[2]

Death from rupture of the spleen is usually rapid, but occasionally it is delayed,[3] and recovery may apparently occur without operation.

Ruptures of the Kidneys

The *kidneys* are commonly ruptured by violence, though rarely without considerable violence; many cases will be found in the medical press.

As a rule there is evidence of direct injury over the region of the kidney, caused by the passage of a motor wheel, a kick, or a blow. The blow may cause contusions or lacerations of the tissue of the kidney, the capsule, the perinephric tissues, the pelvis or the pelvis.

Though hæmaturia is common, it is by no means invariable. A rupture of the kidney may be produced without any prominent symptoms and cause death in a few hours.

[1] Coleman, A. H., 1939. *Brit. J. Surg.*, 27, 173.
[2] Smith, S., 1920. *J. R. Army med. Cps.*, 46, 269.
[3] Sterpnol, E. J., 1940. *Amer. J. Surg.*, 49, 129.

A man, aged 60, was run over by a light cart. He walked to the house of a friend at a short distance and went with him to the hospital in a cab. It was found that three ribs were fractured, but there was no urgent symptom or sign of collapse. He was treated for fractured ribs, and then walked home with his friend and went to bed. Between five and six hours after the accident he was observed to sit up in bed and suddenly fall back dead. On inspection no bruise or wound of any kind was found on the injured side. There was a large quantity of fluid and coagulated blood in the abdomen: the right kidney was torn in half transversely through the pelvis. The ninth, tenth, and eleventh ribs were fractured. Blood had presumably escaped slowly or intermittently from the ruptured organ.

Contusions of the kidney in themselves may not cause serious symptoms, and spontaneous healing of these injuries sometimes occurs.[1]

The "Crush Syndrome". Secondary kidney damage is a feature of crushing injuries involving pinning of muscle—for example, in persons pinned under fallen masonry in bombed houses. Œdema and anuria accompanies the shock in these cases, and if death occurs the kidneys are found swollen and pale, with marked degeneration of the cells lining the tubules and with masses of debris in the tubules. The condition is often referred to as the "crush syndrome".[2][3]

Wounds and Ruptures of the Intestines

Rupture of the intestines sometimes occurs from disease, and in a case of rupture alleged to have been produced by violence we must always take this into account. The ruptured part of the bowel should be carefully examined in order to see whether there are any signs of ulceration or new growth. If not, and if there is clear evidence of violence having been used, it is impossible to admit this speculative objection. If with the proof of violence there should also be a diseased condition of the bowel we may be required to say whether this did not create a greater liability to rupture, a point which must be admitted. The intestines may be ruptured by very slight causes. Any force, as a slight blow *suddenly* applied to the abdomen, will sometimes suffice to cause it.

We have seen cases in which there was no doubt that the ileum had been ruptured by a kick on the abdomen, leading to death by peritonitis, and in which the colon was ruptured by a prod from stumbling on to a barrow handle, with the same ultimate result.

Rupture of the intestines does not necessarily deprive a person of the power of locomotion.

A boy, aged 13, had his duodenum completely ruptured across by a blow; he walked a mile with but little assistance, but he died in 13 hours. A boy of 13 was struck by a cricket-ball in the right groin, in spite of which injury he remained on the ground more than an hour and a half and then walked more than a mile to his home. He died on the fifth day from peritonitis as a result of rupture of the intestines and escape of the contents. *In this case a contusion may later have given way.*

A man brought into Guy's Hospital in Taylor's time was able to walk to his bed, and he did not appear to be seriously injured, although it was stated that a bale of wool had fallen on him. In the evening he became collapsed, and died 12 hours after admission. Nearly a pint of blood was effused in the abdomen, and a portion of the ileum was found lacerated, the laceration extending into the mesentery and including the blood vessels. The laceration was about an inch and a half long, and the bowel was divided not quite through. The intestines were much matted together by lymph and blood.

[1] Harrison, J. H., 1940. *Surg. Gynec. Obstet.*, 70 97.
[2] Bywaters, E. G. L., and Beall, D., 1941. *Brit. med. J.*, 1, 427.
[3] Mayon White R., and Solonat, O. M., 1941. *Brit. med. J.*, 1, 434.

Rupture of the intestines is commonly due to traffic accidents, to crushing injuries, and to falls from a height. The jejunum is probably the commonest site, followed by the ilium, duodenum, and large intestine.[1] The damage varies with the nature of the violence, and one may find complete section of the bowel in severe crushing injuries where the bowel is nipped between the vertebræ and the applied force, a series of semi-circular splits in less violent injuries, bursting effects, surface contusions or simple tearing of the mesentery. Death may be due to shock, hæmorrhage, infarction or peritonitis. In many cases of abdominal violence paralysis of the bowel (ileus) may occur and lead to death, even when no particular lesions can be found. In blast injuries from high explosives, hæmorrhage and lacerations of the bowel are frequently found.[2]

Punctured wounds consist chiefly of stab wounds and bullet wounds. Occasionally perforation of the abdominal cavity occurs without damage to its contents, but usually the gut is wounded in a number of places. Death may be due to hæmorrhage, shock, or peritonitis.

A peculiar type of rupture of the gut due to practical joking with compressed air has also drawn attention. Andrews,[3] quoting 16 cases of this kind of traumatism, has shown that it requires a pressure of only seven to twelve and a half pounds to rupture the gut. In many of the cases the nozzle of the compressed air pipe was some inches away from the anus, and the victims were fully dressed. Rupture of the large bowel is likely to take place, and the inflation of the gut causes rapid unconsciousness in some instances.

Wounds and Ruptures of the Stomach

Perforating wounds of the stomach may be due to stabs or firearm wounds. Non-perforating injuries may be caused by blows, crushing or sudden over distention as in cases where an anæsthetic tube lies in the gullet by mistake.

In crushing injuries the stomach is much less likely to be injured than the small intestine owing to its less exposed position, but it may be damaged, especially if distended, by any of the forms of violence described under intestinal injuries, and as in these viscera, contusion or rupture may occur without leaving any trace of violence on the surface of the body. If the stomach is empty at the time of the violence it has little chance of rupture. If it is full severe pressure may rupture all coats of the organ, or, more commonly, the mucous and submucous layers only. In these latter injuries symptoms may be delayed for several hours. Complete rupture may occur subsequently with the onset of severe symptoms and danger to life.

The following cases illustrate the common forms of rupture of the healthy stomach:—

A little girl of 21 months wandered away from her parents shortly after eating her lunch, and was heard climbing the stairs. A few minutes later there was a dull thud and she was found on the ground, face down *across a stone step*, 15 feet below an open window. She died five hours later, without surgical intervention. Autopsy revealed a 2½ inch split across the front of the body of the stomach. The abdominal wall was unmarked.

A woman of 72 was having a dental extraction under chloroform from a Junker inhaler with a nasal catheter. Some teeth were extracted and, as attention was being directed to the other side of the jaw, the woman collapsed. The catheter was removed and attached to a cylinder of oxygen, being passed 'into the trachea'

[1] Counsellor, V. S., and McCormack, C. J., 1935. *Ann. Surg.*, 102: 363.
[2] Graves, F. C., *et al.*, 1943. *U.S. Naval Bull.*, 41, 859.
[3] Andrews, E. W., 1911. *Surg. Gynec. Obstet.*, 12, 63.

under direct vision. A nurse turned on the coarse valve of the cylinder suddenly, but the *patient's abdomen quickly became distended* and she died immediately after. At autopsy much free gas blew out of the abdomen under pressure, and a complete rupture of the stomach was found near the cardiac orifice.

The stomach of a man who had fallen into the Thames from a barge as a result of a collision was found to contain swallowed air in unusual quantity, together with some finely silted matter; the mucous membrane in the immediate neighbourhood of the cardiac orifice bore several longitudinal splits, one some 2½ inches in length.

Ruptures of the Bladder

This injury may occur as a complication in fracture of the pelvis; as the result of a fall, a kick, or a blow on the abdomen when the bladder is distended, from perforating wounds, or spontaneously from pathological causes. The rupture may be intra-peritoneal or extra-peritoneal; in the former case the urine passes into the peritoneal cavity, in the latter it passes out into the pelvic cellular tissues or spreads between the peritoneum and the abdominal wall.

Rupture from a kick or a blow is due to pressure on the contained urine, and as this pressure is exerted uniformly over the whole surface the bladder ruptures at its weakest point, usually over its upper and back surface, especially if it is full. In cases in which it is not full a severe kick may cause a rupture towards its lower pole.

Rupture is much less common in females owing to their relatively simple urethra. It is most common in cases of drunkenness owing to the liability to distention of the bladder.

In all cases of rupture of the bladder there is a definite risk to life. A person may die suddenly as a result of shock, after several days from peritonitis or weeks later from urinary complications.

A man while struggling with another, received a severe kick on the lower part of the abdomen. He fell backwards, and died immediately. On inspection, the brain—was congested but otherwise healthy; the bladder presented, on the left side of the body, a rent of about 2 inches; but this organ was in other respects healthy, as well as the urethra. There was some bloody effusion in the cellular tissue. The peritoneum and viscera of the abdomen were uninjured. There were no marks of violence on the body.

When such ruptures are produced by blows, they are rarely accompanied by marks of injury to the skin. There may thus be no means of distinguishing *by external examination*, whether a rupture was really due to violence or to spontaneous causes.

During a quarrel one man struck another a severe blow on the lower part of the abdomen. The latter was carried home, confined to his bed, and died in seven days. There were only a few superficial abrasions on the skin of the abdomen. The bladder was found ruptured to the extent of 2 inches in its upper and back part; it was highly inflamed. Throughout the abdomen there were the marks of general peritonitis, of which the man had died.

Some doubt was thrown on the correctness of the medical opinion that the rupture had been caused by a blow, because there was no mark indicative of a severe blow over the region of the bladder. The witnesses properly answered that ruptures of the viscera of the abdomen from violence were not necessarily attended with the marks of violence found in injuries to other parts, owing to the yielding and elastic nature of the parietes. One of them mentioned a case that had occurred in his practice where a soldier had received in the abdomen a kick from a horse, which had ruptured the small intestines, and caused death, but there was not the slightest trace of violence externally.

In another case, the accused, who was intoxicated, met the deceased on the high-road, and without any provocation gave him a violent kick on the lower part of his

abdomen. The deceased turned sick; he attempted to pass his urine, but could not; he was conveyed home, and died from peritonitis in five days. There was no injury to the skin indicative of external violence; but the bladder was found ruptured, and the contents extravasated. The rupture was attributed to the blow inflicted by the. accused.

For the defence, it was contended that, as there was no mark of a blow, the rupture might have occurred spontaneously from simple over distension. The judge observed that, if the rupture were thus occasioned, it was remarkable that it should have happened immediately after a violent blow had been struck on the part. The distension of the organ might, however, have rendered the blow *more dangerous* than it otherwise would have been. The accused was convicted.

As an attempt may be made, in cases in which death has resulted from this injury, to refer rupture of this organ to natural causes, it may be observed that this is an unusual occurrence. The normal bladder can withstand enormous distension without rupture. In one case a boy who had tied a piece of string round his penis later died from urinary retention and pressure. His bladder filled practically the whole of the abdomen and was stretched as thin as paper without rupturing. A rupture is almost always the result of violence applied while the organ is in a *distended* state. A *spontaneous rupture* may, however, occur: (1) when there is "distension with overflow" from disease; (2) when the bladder is ulcerated, or otherwise diseased; (3) when there is an obstruction in the urethra from stricture or other causes. (4) Cases are recorded in which no cause whatever could be found. The causes of spontaneous rupture are recognizable both by ascertaining the previous condition of the deceased and by examining the bladder and urethra. If a man were in good health prior to being struck; if he suddenly felt intense pain, could not pass his urine afterwards, and died from an attack of peritonitis in five or six days; if after death the bladder were found split, but this organ and the urethra were otherwise in a healthy condition, there can be no doubt that trauma must have been the sole cause of rupture. A diseased state of the bladder would probably diminish the responsibility of an accused person for the consequences; therefore the state of this organ should be recorded with care on these occasions.

Rupture of the bladder is liable to occur in women during parturition, owing to the pressure of the child's head, an occurrence which may result in a charge of malpraxis against the medical attendant. It may also occur by perforation from the vagina in cases of abortion, from perforation from within by a cystoscope, catheter or other body introduced through the urethra.

The occurrence of post-traumatic neurogenic disturbances of bladder function—mostly after brain or spinal cord injury is well known: Moritz reviews the subject in his Pathology of Trauma.[1]

Wounds of the Genital Organs

Wounds of the sexual organs, apart from those accompanying rape (Vol. II), may be self-inflicted in cases of insanity, or they may be inflicted from motives of revenge. They are occasionally inflicted for the purpose of sexual gratification. They may be produced by kicks, falls or blows. Although injuries to the private parts are likely to produce shock and free hæmorrhage they are by no means uniformly fatal. Many cases of amputation of the penis and testicles have recovered and Littlejohn[2] describes a case in which a

[1] Moritz, A. R., 1954. The Pathology of Trauma, 2nd Ed., London, Henry Kimpton.
[2] Littlejohn, H., 1925. "Forensic Medicine". London: Churchill.

deserted female enticed her paramour to get into bed with her and when he was about to have sexual connection she seized his penis and cut it off with a table knife. The man recovered and was afterwards the father of several children. Similarly the amputation of the penis and testes of young negroes to convert them into eunuchs, though proving at times fatal, is commonly successful.

Incised, lacerated, or even contused wounds of the female genitals may prove fatal by loss of blood, not from the wound involving any large vessel, but from the numerous small vessels which are divided, as there is a good deal of erectile and very vascular tissue in the neighbourhood. Two women were in this way murdered in Edinburgh many years ago. The wounds were inflicted by razors, and the women bled to death.

A woman of 36 received a kick from her husband in the lower part of the abdomen, while she was in a stooping posture. When seen in about three-quarters of an hour, she had lost from four to five pints of blood. She was sinking, and expired a few minutes afterwards. On inspection there was no injury to the uterus or vagina; the wound was situated at the edge of the vulva, extending from the pubes along the ramus of that bone. It was about an inch long and three-quarters of an inch deep. The crus clitoridis was crushed throughout its length, so as to exhibit its cavernous structure. The fatal bleeding had occurred from this.

SELF-INFLICTED, ACCIDENTAL AND HOMICIDAL GENITAL WOUNDS

A practitioner may sometimes be required to determine whether wounds affecting the female organs have resulted from accident, have been self-inflicted, or inflicted by others with homicidal or sexual intention.

A woman received a 1½-inch long cut in the genitals on the left side and a smaller wound of the same type on the right side. The accused alleged that the woman had inflicted the injury on herself; and Easton, on being required to state his opinion on the question at issue, came to the conclusion—(1) from the regular edges of the wounds, that they had been produced by a clean-cutting instrument, and therefore could not have been caused by a fall, excepting the person had fallen upon some sharply cutting projection; (2) if the woman had herself thrust a knife into the private parts, the situation and direction of the wounds would have been different. There was, however, a want of proof to connect the accused with the act, and he was discharged.

In *R. v. Heath* (C.C.C., 1946) a tear was found in the vagina, extending up the right wall from a point about 1 inch from the vulval orifice into the fornix and across the vault of the vagina behind the cervix: bleeding had been copious. The injury was instrumental, it being probable that a poker had been used. Heath was a sex pervert.[1]

It is necessary to draw attention to the fact that, owing to the proximity of the pubic bones, these parts behave under violence in a manner very similar to that in which the scalp behaves; that is to say, blunt violence may produce an apparently incised wound. Hence wounds of this region require very careful and minute examination, to determine their real character.

We may say, in general, that if the patient is insane and especially if the form of insanity has any leaning towards sexual ideas, then wounds in this situation may be regarded as a likely attempt at suicide. If, on the other hand, there is no question of insanity, then a wound in this region is almost certainly accidental or homicidal.

Accidental wounds of the genitals, unless all the circumstances are known, may sometimes resemble those produced by design.

[1] Simpson, K., 1947. *Police J.*, 20, 266.

A girl, aged 6, fell from a tree with her legs apart upon one of the sharp-pointed shoots less than half an inch thick. This entered the vagina, and passing through its posterior wall, broke off. The wood was removed with some difficulty and the *child died in 28 hours from peritonitis.* If, later, the child had been found dead with the wood in her body, there might have been some difficulty in assigning an accidental origin to the injury.

One of the authors was called to see a woman found dead in a country ditch near Sawbridgeworth, Herts. The body showed injuries of the face due to a blunt instrument and injuries to the neck suggesting an attempt at strangling. The vulva was split and bruised at both sides suggesting a sexual assault. The vulval injuries were so gross, however, that rape seemed highly unlikely. C.I.D. enquiry revealed that a boy of 16 had been riding his bicycle at night along the country lane leading to his home when he had suddenly come, in the dark, upon a woman squatting in the centre of his path urinating. He ran straight into her, his handlebars striking her face a moment after his front wheel had run into her crutch region. The "rape" injuries had been caused by the bicycle.

Homicidal wounds are by no means rare, as the parts offer to a brutal or drunken man a point of attack to which his mind instinctively turns.

When a woman is pregnant the bleeding from such injuries is always likely to be more profuse, but is, of course, not always fatal.

The following remarkable case[1] illustrates the extensive injuries which may occasionally be inflicted without causing death;

A woman, three months pregnant, while going downstairs, tripped on one end of a loose stair-rod, which was sharp-pointed. She fell, and the rod, coming up like a tip-cat, entered her perineum. On admission to hospital 3 inches of the stair-rod were seen protruding from the left side of the perineum.

On opening the abdomen it was found that the rod had traversed the vagina and transfixed the right broad ligament, passing beside the pregnant uterus. It crossed the pelvis without injuring the gut, pierced the external iliac vein, and entered the psoas muscle. Running upwards in the muscle, it was next seen crossing the interval between the duodenum and the liver, and disappearing into this latter organ.

The rod was removed gradually by traction on its lower end. The rod was 2 feet 6 inches long, and it was evident that the point must have reached the level of the manubrium sterni, after piercing the diaphragm and the lung.

Convalescence was uninterrupted, except for the coughing up on one occasion of an ounce or two of pus, presumably from a lung abscess, and the pregnancy was continued, the patient being discharged fit and well. Unfortunately, however, labour at full term was complicated by intestinal obstruction from adhesion of a loop of gut to the laparotomy scar, and death took place.

inquiry. In a case of fractured skull leading to death from inflammation of the brain, it was proved that the bones of the skull were exceptionally thin and brittle, and this led to a mitigation of punishment.

Spontaneous Fractures. Though there is no appearance of disease, a fracture may be ascribed to spontaneous causes. Thus, bones have been fractured by moderate muscular exertion, even, in the case of ribs, by coughing. Fracture from muscular spasm was common in convulsion therapy in mental conditions.

The elbow (olecranon) heel-bone (os calcis), knee-cap (patella), and femur in old people may become fractured by muscular exertion. The other long bones are not so frequently the subject of an accident of this kind; but the arm (humerus) in a healthy man has been broken by the simple muscular exertion of throwing a cricket-ball. "Stress-fractures" of the tibia was described during the 1939-45 war, due to prolonged marching.

A young lady fractured the neck of the scapula by suddenly throwing a necklace round her neck. A man, of 40, was bowling at cricket, when on delivering the ball he and some of the spectators heard distinctly a sharp crack, like the breaking of a dry piece of wood. He fell to the ground as if he had been shot. The thigh-bone was found to be fractured, evidently from muscular exertion only. While a strong young Scotsman was in the act of "putting" a 16 pound shot, making at the time a violent effort, he felt something snap in his arm and instantly lost all power over it. It was found, on examination, that the humerus had been broken by muscular force. Spontaneous fracture of the femur occurred in a healthy man of 23, who was placing one leg over the other to look at the sole of his foot, when he heard something give way, and the right leg immediately hung down. The right thigh-bone had been transversely fractured at the junction of its middle with the lower third.

In fractures arising from this cause there will be no abrasion of the skin, nor any appearance to indicate that a blow has been struck; while the marks of a blow would be incompatible with fracture from muscular action. It is unusual that the ribs should be fractured from muscular exertion; but a case occurred which shows that this accident is possible.

A strong healthy labourer, aged 45, slipped while walking and saved his footing only by the exertion of considerable strength. While recovering his balance he felt a sharp pain on his right side, which was aggravated by inspiration and by exertion, so that he reached home with difficulty. On examination, a tender area was found in the axillary region over the seventh and eighth ribs. Crepitation was not distinct, and it was supposed that a rupture of the muscular fibres had taken place. Pleurisy developed and the patient was confined to bed for a fortnight; when all traces of pain had left the part, the deposition of callus (new bone) plainly showed that there had been fractures of the seventh and eighth ribs. No X-ray examinations appeared to have been made.

Fractures are not ordinarily *dangerous to life*, though death may occur from injury to adjacent organs, from shock, hæmorrhage, fat embolism, or following confinement, from pulmonary embolism or hypostatic pneumonia. Healing may not take place and a false joint may be formed; it may take place in bad alignment or fusion of two bones may occur leading to loss of function, or the fracture may set up secondary effects in adjacent joints. They must therefore be considered serious injuries.

Slipping of an epiphysis is common in childhood—most common in the distal end of the radius, internal epicondyle of the humerus, capitellum and distal end of the tibia: inhibition of growth may follow.

The curious "aseptic necroses" of the head of the femur (Perthés), scaphoid (Köhler), semilunar (Kienböck) and other small bones which is said to follow

trauma, is likely to be due to a tearing away of growing bone from the blood supply: in this respect it is probably often traumatic in origin.

Fractures in the Living and Dead Body. It is not always easy to say whether a fracture has been produced *before or after death*. A fracture produced shortly before death, and another shortly after death, will present similar characters to the naked eye, except that in the former case there will be more blood effused, and it will penetrate further into the adjacent tissues. A fracture caused some hours before death would be indicated by œdema and active cellular infiltration into the surrounding parts and between the fractured edges of the bones, as well as by similar changes in the injured muscles; if for a longer period before death, there may be the signs of commencing organization. Fractures caused after death are not accompanied by such changes. A medical witness may be asked how long the deceased survived after receiving the fracture. This is a question which can be decided, if at all, only by a complete histological and radiological examination of the fractured part. In the first few hours a hæmatoma is formed around and about the broken ends of the bone. Exudation causes increased swelling of the tissues, the blood clots, the damaged area becomes infiltrated with cells, capillaries are formed and gradually a firm tissue or callus forms a scaffolding round the fractured ends. This callus is in course of time transformed into bone. Most accounts of healing in bone give a time table of these events from the first few hours until union occurs,[1] but it is extremely difficult to give an opinion with any considerable degree of precision. We can say whether a person lived for a long or a short time after receiving a fracture, but to specify the exact time is clearly impossible, since this process of restoration in bone varies according to age, constitution, and many other circumstances, such as the site of the fracture, the degree of apposition of the ends, immobilization, etc. In young persons bones unite rapidly, in the old slowly; in the diseased and unhealthy the process of union is slow, and sometimes does not take place at all.[2] It requires a period of several months for the callus to acquire all the hardness, firmness, and powers of resistance possessed by the original bone. Though there may be quite firm union in a long bone in a matter of four to six weeks it is doubtful if bony reconstruction is structurally completed under about six months.[3] (See Fig. 28).

X-ray examination enables the medical observer not only to establish the absence or presence of a fracture but to obtain an idea of its age and sometimes information about the method of its infliction.

Has a Bone ever been Fractured? This question is sometimes put in reference to the *living* body. It is well known that a bone seldom unites so evenly that the point of a bony union is not indicated by a node or some thickening. Some bones are so exposed as to be well placed for this examination, as the radius, the collar-bone, and tibia; in others the detection is difficult by palpation, but X-ray examination will usually enable the observer to localise an old lesion. If healing is complete it is impossible to say when the fracture took place; it may have been six months or six years before, as after full healing the bone undergoes no perceptible change. These facts are of importance in relation to the *dead* as well as the living, since they will

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[1] Watson-Jones, R. Fractures and Joint Injuries. 4th Ed., 1952. Edinburgh: Livingstone.
[2] Wright, G. P., 1954. An Introduction to Pathology. 2nd Ed. London: Longmans Green.
[3] Clark, W. E. Le Gros, 1952. The Tissues of the Body. 3rd Ed. London: Oxford University Press.

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Fractures in the Living and Dead Body. It is not always easy to say whether a fracture has been produced *before or after death.* A fracture produced shortly before death, and another shortly after death, will present similar characters to the naked eye, except that in the former case there will be more blood effused, and it will penetrate further into the adjacent tissues. A fracture caused some hours before death would be indicated by œdema and active cellular infiltration into the surrounding parts and between the fractured edges of the bones, as well as by similar changes in the injured muscles; if for a longer period before death, there may be the signs of commencing organization. Fractures caused after death are not accompanied by such changes. A medical witness may be asked how long the deceased survived after receiving the fracture. This is a question which can be decided, if at all, only by a complete histological and radiological examination of the fractured part. In the first few hours a hæmatoma is formed around and about the broken ends of the bone. Exudation causes increased swelling of the tissues, the blood clots, the damaged area becomes infiltrated with cells, capillaries are formed and gradually a firm tissue or callus forms a scaffolding round the fractured ends. This callus is in course of time transformed into bone. Most accounts of healing in bone give a time table of these events from the first few hours until union occurs,[1] but it is extremely difficult to give an opinion with any considerable degree of precision. We can say whether a person lived for a long or a short time after receiving a fracture, but to specify the exact time is clearly impossible, since this process of restoration in bone varies according to age, constitution, and many other circumstances, such as the site of the fracture, the degree of apposition of the ends, immobilization, etc. In young persons bones unite rapidly, in the old slowly; in the diseased and unhealthy the process of union is slow, and sometimes does not take place at all.[2] It requires a period of several months for the callus to acquire all the hardness, firmness, and powers of resistance possessed by the original bone. Though there may be quite firm union in a long bone in a matter of four to six weeks it is doubtful if bony reconstruction is structurally completed under about six months.[3] (See Fig. 28).

X-ray examination enables the medical observer not only to establish the absence or presence of a fracture but to obtain an idea of its age and sometimes information about the method of its infliction.

Has a Bone ever been Fractured? This question is sometimes put in reference to the *living* body. It is well known that a bone seldom unites so evenly that the point of a bony union is not indicated by a node or some thickening. Some bones are so exposed as to be well placed for this examination, as the radius, the collar-bone, and tibia; in others the detection is difficult by palpation, but X-ray examination will usually enable the observer to localise an old lesion. If healing is complete it is impossible to say when the fracture took place; it may have been six months or six years before, as after full healing the bone undergoes no perceptible change. These facts are of importance in relation to the *dead* as well as the living, since they will

enable us to answer questions respecting the identity of skeletons found under suspicious circumstances, and here medical evidence may take a wider range, for a fracture in any bone may be discovered, if not by external examination, at least by sawing the bone longitudinally through the suspected broken part when, should the suspicion be correct, the bony shell will be found thicker and less regular in the situation of the united fracture than in the other parts. In such cases it may be easy to say whether a fracture is recent or of old standing.
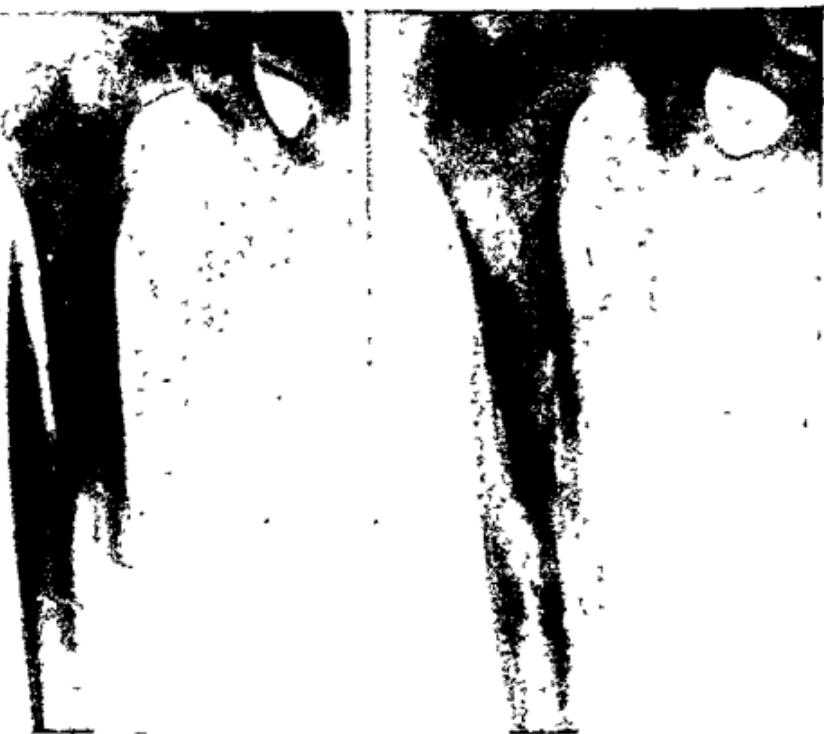
Fig. 28. X-rays of a fracture of the femur in an adolescent girl taken on Jan. 13th and March 15th, 1955 showing how the process of repair may be measured radiographically. Note the confined growth of callus in this case.

With respect to the power of *locomotion* after a fracture, it may be observed that when the injury is in shoulder girdle, the arm or in the ribs--unless many of them are broken- a person may be able to move about, although unfitted for struggling or making great exertion. Fractures of the hip girdle or in the leg generally incapacitate persons from moving, but cases of persons hobbling about with a broken limb, no doubt due to impaction of the broken ends, are not uncommon, especially with "crush" fractures of the spine or impacted fracture of the femur. Fracture of the fibula may cause little disability.

DISLOCATIONS

Dislocations are not frequent in the old or in those persons whose bones are brittle. A witness is liable to be asked, what degree of force, and acting in which direction, would produce a dislocation—questions seldom difficult

to answer. They are not dangerous to life, unless of a compound nature, when death may take place from secondary causes. A dislocation which has occurred in the *living body* may be identified as such by a laceration of the ligaments of the joint and of the soft parts in the neighbourhood of the joint, and by the copious effusion or organization of blood. If of old standing, a dislocation would be identified by the organization of adjacent structures. Dislocations may occur from *natural causes*, as from disease and destruction of the ligaments in a joint; also from violent muscular spasm during an epileptic convulsion or electro-convulsive therapy. When once a dislocation has occurred its recurrence from very slight cause is very frequent. There is of course great pain in the joint on trying to move it or throw weight on it, but under stress of circumstances a person with dislocated ankle, knee or hip may hobble a long way.

Further remarks on fractures and dislocations will be found in the section on Injuries to the Head (p. 315), Spine (p. 319), and under "Malpraxis" (p. 60). The development of fat embolism is referred to on page 241. The subject may be explored further in Payling Wrights "Introduction to Pathology". 2nd Ed., 1954 (Longmans Green & Co.).

tests for the origin of the blood, human or otherwise, and finally agglutination tests for the group of the particular blood.

Microscopic Examination. An attempt should be made to obtain a specimen of the cells in the stain for microscopic examination by maceration in a drop of normal saline before proceeding to the chemical tests (see p. 349 for details). The diameter of round red cells must be measured.

Methods of obtaining material for analysis. These depend upon the fact that the red colouring matter of blood is when quite fresh, easily soluble in cold water. When it is older, its solubility in water is diminished; and if it be old enough to be entirely converted into hæmatin, and perhaps even into iron-free hæmatin, it requires solvents with greater dissolving power. The rapidity of solution in water or normal saline and other solvents give some indication of the age of the stain, but is subject to so many variations that no precise opinion about the age is usually possible. Amongst the simplest, and therefore the best, solvents are (*a*) a 10 per cent solution of potassium cyanide, (*b*) a 10 per cent solution of glycerine in distilled water; (*c*) a weak solution of ammonia. Heat has a somewhat similar action on hæmoglobin to that which age exerts, breaking it up into hæmatin and globulin. In the case of a dead body found burnt, or pieces of charred furniture and similar articles which have been exposed to considerable heat, but with stains on them resembling those of blood, due allowance must be made for this change by prolonging the efforts at obtaining a solution, or by using other methods which will be described.

Whatever be the material which is submitted to an expert for examination, the same method of procedure must in the first instance be adopted, viz., to place a part of the material in a small quantity of one or more of the above solutions. If no coloured solution is obtained at once, the material must be covered and left for from 12 to 24 hours, at room temperature. If blood be present there will, by this time, have appeared a red or reddish brown coloration in the liquid, or if minimal quantities are involved, a drop or two of a similar coloured fluid. Oil or grease in a stain interferes considerably with the solubility of blood stains, and if this is present the stain may be first brushed over with a little ether, in which oils and fats are readily soluble. From a metal weapon a piece of coagulum or a suspected spot must be scraped off with great care so as to prevent it being mixed with rust. Stains on wood, leather, etc., may be gently scraped into a watch glass. Stains on clothing may be scraped off or a fragment of the material cut and also placed in a watch glass. The specimen so obtained is then moistened with a small quantity of any one of the solvents and allowed to stand until a solution is obtained. If the weapon or material has been exposed to heat, so as to destroy the blood pigment, a dilute solution of ammonia may be effective.

slow. *Washed stains* may be detected by means of the benzidine, guaiacum, or other colour test, but it is extremely difficult to obtain conclusive evidence of the presence of hæmoglobin if the stain has been well washed. Nevertheless, the fact that the benzidine test is positive is important to note, for example:

In *H. M Advocate v. Porth* (1944), the trousers of the accused gave a positive test over the front of the knees and round both side pockets, as did his tie and shoe laces. Blood was found in the instep of both shoes with fibres from the coat of the victim embedded.

In *R. v. Sangret* (Kingston Assizes, 1943) a girl had been battered on the head after a knife attack which she had evidently warded off with her right hand. An Army issue blanket found in the possession of accused had been freshly washed, but bore faded benzidine-positive stains in areas corresponding to the position of the head and right hand of the body lying wrapped in it.

In *R. v. Whiteway* (Kingston Assizes, 1953) accused's shoes, which had evidently been washed, bore benzidine-positive stains on their welt joints and in the cracks of the lace flaps. 60 days had elapsed between the crime and the examination of the clothing.

TESTS FOR BLOOD

The Benzidine Test. This is the best preliminary test for blood, and by means of it a large number of possible stains may be examined and those that give a positive test marked out for further examination,

It is a preliminary sorting test—that is to say, if a positive result is obtained it is not proof of the presence of blood, but if no positive test is obtained it is proof that the stain is not blood and need not be further examined.

The test depends on the presence in blood stains of a peroxidase or similar substance which in the presence of hydrogen peroxide oxidises the colourless benzidine sulphate into a rich blue-coloured salt. The reaction is given more readily with blood than with any other substance, but a reaction can be obtained with pus and certain plant and animal juices which contain oxidase, and also with commercial formalin. According to Callow, the test is given by many bacteria such as B.Coli prodigeosis, fæcalis, etc.[1] Benzidine sulphate is readily oxidized to its blue salt by any oxidizing agent such as permanganate of potash, chromates, etc., in the absence of hydrogen peroxide, so that it is essential in performing the test to *add the benzidine solution first and observe whether any action occurs* before adding the hydrogen peroxide. If a blue colour is obtained without adding the peroxide, the test is valueless.

The solutions used are:—

    (a) Benzidine [paradiamino-diphenyl] sulphate dissolved in glacial acetic acid to form a 10 per cent solution, or stronger if desired.

    (b) Fresh active hydrogen peroxide (20 vols.)

A piece of white filter paper is pressed on the stain, a few drops of the benzidine solution are run on to the paper and left for half a minute to ascertain whether any colour change occurs, then a few drops of hydrogen peroxide are run over the benzidine on the paper.

If blood is present, in however minute a quantity. a blue colour appears at once when the hydrogen peroxide is added. If it should appear before adding the peroxide it indicates the presence of any oxidizing agent, but not blood. On no account must the reagents be added to the stain *in situ*, for that would interfere with the subsequent tests. Instead of rubbing the stain with dry filter paper a minute fragment may be scraped off the specimen on to the paper, but this is usually not as good as the former method.

¹ Callow, A. B., 1926. *Biochem. J.*, 20, 247.

The test is given by blood of almost any age, blood that has been subjected to heat or cold, blood stains treated with carbon tetrachloride, benzene and similar cleaning agents. It is given when a blood-stained article touches another, or when a blood-stained hand is placed in the pocket, even when the stain is dry, and on articles on which no trace of blood can be seen by the naked eye or lens. It is, therefore, invaluable in localizing stains which may be due to blood.

There are a number of preliminary tests similar to the benzidine test and depending equally on the presence of peroxidase; for example, the guaiacum test, the leucomalachite green, the phenolphthalein, the pyramidon tests, etc., but these offer no particular advantages over the benzidine test.

The Guaiacum Test. If to a little of the watery solution of the stain a few drops of alcoholic solution of guaiacum resin be added, a dirty reddish brown precipitate is formed. A little ozonic ether or solution of peroxide of hydrogen is then added, when the mixture will assume more or less rapidly a beautiful deep blue colour, or if ozonic ether has been used, the ether which floats on the mixture or rapidly rises to the surface after thorough mixing is coloured blue.

The Phenolphthalein Test (Kastle Mayer Test). This test also depends on the presence in blood of a peroxidase, and, like the guaiacum and benzidine tests, must be considered in its true character—that is, as a test for peroxidase, and not as a test for blood. It is well to remember this, for assertions are constantly being made that one or other of these tests is a definite test for "blood".

The reagents for the phenolphthalein test consist of two substances, hydrogen peroxide (20 vols.) and phenolphthalein.

The latter is prepared as follows:—

Phenolphthalein.	.	.	.	.	.	2 g.
Potassium Hydroxide	.	.	.	.	.	20 „
Distilled water, to	.	.	.	.	.	100 ml.

These are boiled, and while boiling, 20 g. of powdered zinc are added. Boiling is continued until the solution is colourless. This solution keeps fairly well if a little zinc is left at the bottom of the bottle.

To carry out the test a few drops of the reagent, followed by a few drops of hydrogen peroxide, are added to a solution of the stain in water. If blood is present a pink or purple coloration is at once produced. The test is extremely delicate, giving reactions with dilutions of one part of blood in five millions. Unfortunately the test is equally delicate for traces of copper and other substances.

If a positive preliminary test is obtained, the presence of haemoglobin must be proved. This may be done by spectroscopic examination or by chemical tests for haemin crystals or other crystals derived from haemoglobin.

In practice the spectroscopic examination of the material is preferable owing to its rapidity and if desired a compound test for spectroscopic absorption and the identification of crystals presents itself in the Takayama or haemochromogen crystal test.

Spectrum Analysis—Spectroscopic Test. The great advantage of this optical process is that it admits of the examination for blood without in any

way interfering with the subsequent application of chemical tests. If the sample owes its colour to recent or oxidized blood, two dark absorption bands will be seen breaking the continuity of the coloured spectrum (No. 1, Fig 29). These are situated between the *D* and *E* lines of the spectrum. The less refrangible of the two bands is the sharper and better defined of the two. If the blood is fairly fresh and of a bright colour (oxyhæmoglobin) the two absorption bands are both distinct and well defined.

The spectroscope used should allow of two tubes being examined at once, for it is desirable to have a specimen of blood mounted for comparing the actual spectrum of blood with that of the suspected specimen.
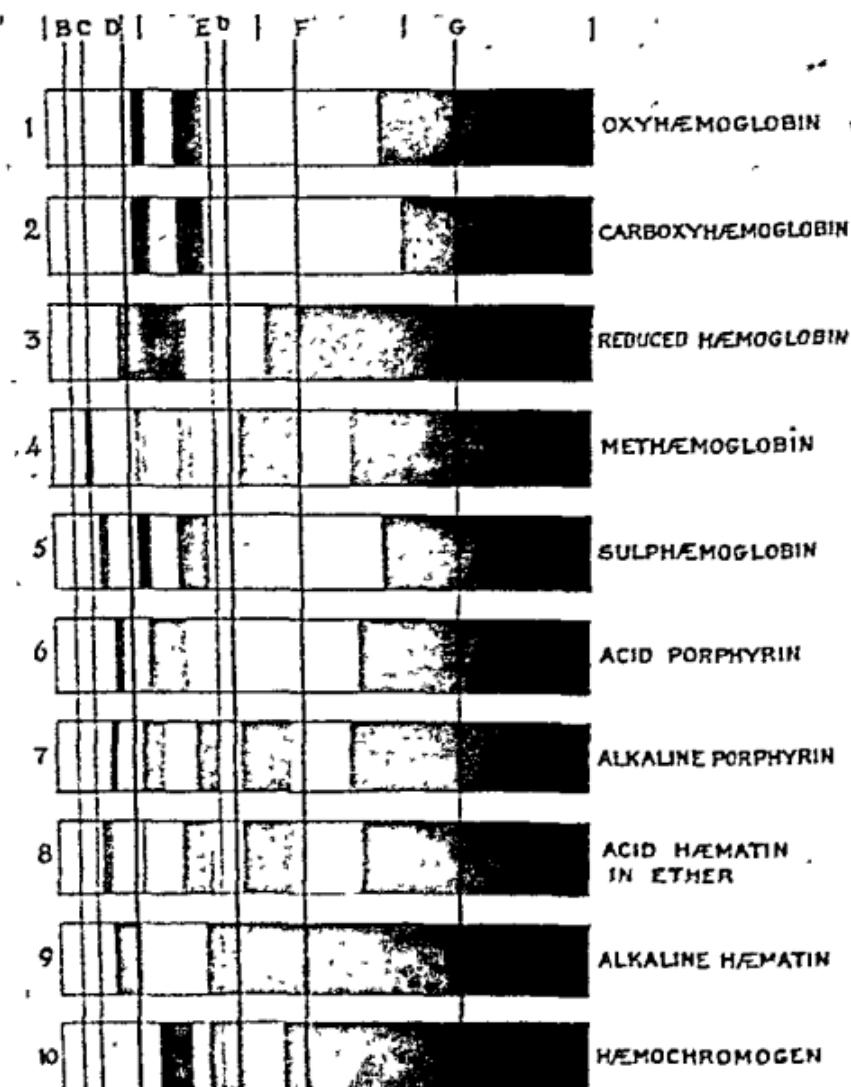
Fig. 29   Absorption spectra of hæmoglobin and its derivatives.   Wavelengths in Angstrom units of Fraunhofer's lines B, 6867; C, 6563, D, 5893, E, 5270; b, 5184; F, 4861; G, 4307.   [from *Harrison, Chemical Methods in Clinical Medicine.*]

All specimens left exposed to air absorb oxygen, but the reduced form of hæmoglobin may be produced by the addition of an ammoniacal solution of ferrous tartrate (Stoke's solution). This solution, which must be fresh, is made by dissolving a fragment of ferrous sulphate in water, adding an excess of tartrate of potassium, and then enough of a dilute solution of ammonia to dissolve any precipitate which may have formed.

Methæmoglobin. When a solution containing blood is exposed to the air for some time it loses its blood-red colour, and assumes a brownish tint. If it is examined by the spectroscope it will be found that a new absorption band has made its appearance between the C and D lines, but somewhat nearer to C than to D (No. 4 Fig. 29). This is the band of the so-called methæmoglobin.

Methæmoglobin may be formed *in vitro* by many substances, such as potassium ferricyanide, potassium permanganate, etc., and it is formed *in vivo* by nitrites, phenacetin, sulphonal, etc. It contains the *same amount of* oxygen as oxyhæmoglobin, but whereas the oxygen in the latter may be removed by the action of a vacuum pump, the oxygen in the former is fixed. It is, therefore, of no value as a respiratory pigment.

Hæmatin. If a solution containing hæmoglobin is acidified with acetic acid, the pigment is decomposed and the solution acquires the brown-red hue of an old blood stain due to hæmatin. The same change is effected by prolonged exposure of *blood to air*. Hæmatin in *acid solution affords a* spectrum the number of bands in which varies according to the solvent employed (Nos. 8 and 9, Fig. 29). Its acid solution in water has a very marked absorption band, extending from about midway between the C and D lines up to C at the red end of the spectrum. If the solution should be now made alkaline with dilute ammonia, the band shifts towards the blue end of the spectrum; it is indistinct and just touches the D line at its most refrangible border.

Hæmochromogen, or reduced alkaline hæmatin, is obtained from blood *by* the action of strong reducing agents in the presence of an alkali. It possesses a most characteristic absorption spectrum comprising two well-marked bands (No. 10, Fig. 29). The first of these is in the yellow part of the spectrum almost midway between the D and E lines, the second in the green, broader, but less distinct.

It is commonly prepared by adding Stokes' reagent or a strong alkali and yellow ammonium sulphide to the solution of the blood stains. A better reducing agent, especially for microspectroscopy, is a solution of sodium hydrosulphite ($Na_2S_2O_4$) made up as follows: 2 g. of sodium hydrosulphite are shaken up with 5 ml. of a 10 per cent solution of sodium hydroxide in a test tube with a rubber cork, and 1 ml. of alcohol added. It must be kept corked and made up freshly for each batch of blood stains. Takayama's solution (p. 350) is also useful for this test.

red side of the D line (608-594) and a broader band which can be resolved into two on the purple side of D (584-548).

Alkaline hæmatoporphyrin may be prepared from the above specimen by gently washing off the sulphuric acid and adding a drop of strong caustic potash solution to the preparation. The absorption spectrum of this substance consists of four bands: one between C and D (620-612), two between D and E (594-568), and a fourth in the green (527-448).

A blood stain, however minute, may, if more or less recent, be made to yield successively all the spectra depicted in Fig. 29; but old blood stains which have become insoluble may yield the spectra only of hæmatin and of the so-called reduced or alkaline hæmatin (hæmochromogen).

Relationship of Hæmoglobin to other Pigments. Our knowledge of the nature of hæmoglobin and its relationship to other naturally occurring pigments has been extended considerably by recent work. Hæmoglobin is generally confined to vertebrates and occurs only rarely in other animal groups; but a number of oxygen carriers have been discerned in invertebrates, sometimes in special cells, sometimes dissolved in the body fluids.

The hæmoglobin molecule consists of four pigment groups known as hæms and a colourless protein residue called globin. Hæm has no characteristic spectrum, but it can be combined with globin or globin substitutes to form hæmochromogen. Several nitrogenous substances, such as pyridine, hydrazine hydrate, nicotine, etc., combine with hæm to produce hæmochromogens which have nearly similar absorption spectra.

This basic substance hæm is found in many other naturally occurring pigments, such as helicorubin, actinohæmatin and cytochrome. The latter is of great interest, for it is found not only in the animal kingdom, but also in bacteria, in yeast, and in the higher plants.

Fischer and his co-workers have claimed to have produced porphyrins from yeast and other substances free from chlorophyll and to have obtained the spectrum of hæmochromogen from them.[1]

Keilin suggests that this is due to the presence of cytochrome.[2] Space does not permit a discussion of these interesting questions, but readers may extend their knowledge of the subject by reference to an excellent review of the literature in Carter and Thompson's "Biochemistry in Relation to Medicine".[3]

Microscopical and Micro-chemical Examination

Attention has already been drawn to the examination of a suspected stain with a lens with the object of discovering small coagula of fibrin on the meshes of a dress material or the surface of non-absorbent stuff, such as stone. The further microscopical tests for blood consist of the demonstration of: (1) the red corpuscles of the blood; (2) crystals of hæmin or chloride of hæmin; (3) crystals of hæmochromogens.

It is desirable when making films for the examination of red cells to search for other cells and foreign substances at the same time. For example, there may be certain peculiarities or pathological conditions of the blood which may be detected; there may be numbers of leucocytes, bacteria of different

[1] Fischer, H., and Zeile, K., 1929. Ann. d. Chem. 468, 98.
[2] Keilin, D., and Hartree, E. F., 1929. Proc. Roy. Soc., Lond., B127, 167.
[3] Carter, C. W., and Thompson, R. H. S., Biochemistry in Relation to Medicine, 2nd Ed., 1952. London Longmans Green

kinds. cells from particular parts of the body, hairs, fibres. etc., all of which may be of importance for the identification of the stain and the reconstruction of the crime.

The Discovery of Corpuscles. There are only two conditions in which it is possible to find the corpuscles of the blood in a state fit for microscopical examination:—First, that the stain shall be quite fresh, and (or) second, that a small fragment of clot shall be available for experiment. When the corpuscles have dried (and in the dried state they are unrecognizable by microscopic observation), it is only with extreme difficulty that they can be induced to return to their natural size and shape.

A portion of the stain or fragment of clot may be removed and macerated in one or two drops of *normal saline on a glass slide.* It should be covered with thin glass, in order to prevent evaporation.

Many other fluids have been recommended for this purpose, but use of *Vibert's solution consisting of common salt 2 g., mercuric chloride 0.5 g., distilled water 100 ml.,* will be found satisfactory.

After moistening a fragment of the stain on a glass slide a cover slip with vaselined edges is applied, and the preparation warmed in the incubator at 37°C., for half an hour. It is then examined directly, and if nothing is seen, the specimen is to be gently teased out and re-examined.

The corpuscles of the blood may be recognized, though they seldom are so perfectly spherical as in the fresh state, and they appear small, and frequently shrunk or corrugated. In some cases only fragments of the envelopes can be seen. Staining by Leishman's solution will facilitate this.

Hæmin Crystal Test. (Teichmann's test). This test, first described by Teichmann in 1853, still remains a valuable and conclusive test for the presence of blood. Teichmann found that when a small quantity of blood was heated with glacial acetic acid, a crop of brown rhombic crystals developed on cooling.

These crystals are due to the formation of hæmin hydrochloride from hæmoglobin by the action of the sodium chloride present in the blood and an added acid, as follows:—A small *dry* fragment of clot, or a bit of the suspected material, is placed upon an ordinary microscope slide; a few drops of glacial acetic acid are then added, and the acid and material mixed thoroughly by means of a glass rod. The smallest possible fragment of common salt is then added; a thin cover slip is placed on the top of the fluid, and the slide is moved gently to and fro over a Bunsen flame until it boils (unless considerable care and dexterity is exhibited in this little operation, the slide may be shattered by the heat or the cover slip blown away); the slide with its contents is then allowed to cool. The hæmin-crystals, if present, appear in groups, as small dark brown specks. They are somewhat irregular in shape—have generally a prismatic form, some with rhombic terminations, while others assume a spindle shape; and others again are joined at an angle, so as to resemble a bird's tail, or they cross each other.

To ensure the production of crystals, three points must be remembered: the acid must be anhydrous, the stain or fragment must be dry, and the slide must not be overheated.

A test solution of 0.1 per cent sodium chloride, bromide and iodide provides a useful alternative fluid for the test.

Another modification which was proposed by Beam may be found of value in those cases where crystals are difficult to obtain by the ordinary methods.

Beam's Modification of Teichmann's Test.[1] A small quantity of the suspected material is placed at the bottom of a flat arsenic sublimation tube about 6 by 3 mm. wide, and 35 mm. long.

"A thin round ignition tube will answer if no flat tube is procurable, but for examination under the microscope the flat form is obviously better. A few drops of acetic acid containing from 0·01 to 0·1 per cent sodium chloride are added, and a very fine cotton thread adjusted, so that its upper end is near the top of the tube and the lower end reaches to the bottom of the liquid. The thread should be everywhere in contact with the tube, to which it adheres readily by being moistened with the liquid. *The adjustment is readily made by means of a glass rod, one end of which is drawn out for the purpose.* The tube is now placed in a rack, or supported by forcing its base into a small blob of plasticine, and allowed to remain until crystallization has taken place.

"The crystals usually begin to appear on or near the upper half of the thread, and are of sufficient size to be distinguished with a power of 75 diameters, in about an hour; and they ultimately become so large that, in place of requiring a magnification of 250 to 300 diameters, as usually recommended, they may readily be seen with one of 25 diameters, or even, in many cases, with a good hand lens. The crystals are best viewed against a dull white background. A piece of white paper is suitable.

"The tube should be thoroughly clean and dry. It is best cleaned by swabbing out successively with acetic acid, water and alcoholic soda, followed by thoroughly rinsing with distilled water and drying on a hot plate.

"The thread should be clean and as fine as can be obtained. A good plan is to take No. 80, 'six-cord sewing machine cotton', and to untwist it, using one of the 'cords' for the test.

"The solution of the blood in acetic acid should not be concentrated, but very weak. *The liquid should only be faintly pink. This ensures large crystals and clean fields. The suspect blood sample must be dry.*"

Hæmochromogen Crystal Test. The hæmin-crystal test is occasionally difficult to obtain, and we have found the hæmochromogen crystal test to be equally good and more easily carried out. It has the additional advantage that the crystals can be examined and their nature confirmed by the spectroscope. Takayama worked out a simple technique for the production of the crystals, which is fully described by Kerr and Mason.[2]

A test solution is prepared as follows:

Sodium hydroxide (10 per cent)	.	.	.	3 ml.
Pyridine	.	.	.	3 "
Saturated solution of grape sugar	.	.	.	3 „
Distilled water	.	.	.	7 „

A few drops of this solution are added to a small portion of the suspected stain on a slide and a cover slip applied. On examination under the low power of the microscope, pink crystals are formed in ten to thirty minutes in the cold, or at once if the preparation is heated until bubbles appear.

These crystals are something like hæmin-crystals, rhomboid in shape,

[1] Beam, W., and Freak, G. A., 1915. *Biochem. J.*, 9, 161.
[2] Kerr, D. J. A., and Mason, V. H., 1926. *Brit. med. J.*, 1, 721.

salmon pink in colour, and disposed in clusters, sheaves and other formations. On spectroscopic examination the absorption spectrum of hæmochromogen is seen.

Is this Stain Blood?

The preliminary examination with the naked eye and a lens commences the process of differentiation thus: iron-mould, together with stains from cochineal, and the red colours of wine, flowers, and fruit, do not cause any stiffening of the fibre of the stained stuff, nor any appearance under the lens at all resembling a direct coagulum of blood; and, again, of the various red colouring matters extracted from vegetable and animal substances, there are none which, to the experienced eye, present in a stain on any fabric the peculiar crimson-red tint of dry blood.

In the next step of examination, viz., that of obtaining a solution for examination, we know that blood in all stages is soluble in a specific solvent. If a microspectroscope is available it is not necessary to remove a solution of the stains, for fragments may be treated on the slide as detailed above. This method is particularly advantageous with minute stains.

There is often a remarkable resemblance between bloodstains on metal and those of the *oxides or certain salts of iron with organic acids*. If the juice or pulp of lemon or orange is spread upon a steel blade, and is exposed to the air for a few days, the *citrate of iron* formed presents the appearance of a blood stain, but none of these should cause difficulty if submitted to laboratory examination.

In old blood stains on rusty weapons, the rust, the blood and perhaps food particles, are mixed together, and require to be separated; water, or ammonia solution, will in time do this so far as the blood is concerned, and the coloured fluid thus obtained may be tested with any of the tests mentioned. If sufficient material is present to allow of filtration of the liquid resulting from maceration, this may be done. If the stain is due to iron-rust alone, this will be separated by filtration, and the liquid will pass through colourless. If we now digest the brown undissolved residue left on the filter in hydrochloric acid, free from iron, we shall obtain a yellowish solution, which will give, with potassium ferrocyanide a blue colour (Prussian blue).

Red Dye Mistaken for Blood. A man was suspected of murder, and on the collar and upper part of the shirt there was a large pinkish-red stain, in some respects resembling washed blood. This appeared to be an unusual situation for blood, and upon testing, the stain was proved not due to soluble blood. On enquiry it was ascertained that the man had worn round his neck a common red handkerchief during a wet night, and while taking violent exercise. The reddish-coloured stain was thus accounted for. There were, however, some other marks on the shirt which required examination. These were on the sleeves, at those parts which would be likely to receive stains of blood if they had been rolled or turned up at the wrists; and it was ascertained that the murderer in this case had used a quantity of yellow soap in washing his hands. These stains were of a brownish colour, and on parts of the shirt corresponding to the armpits, stains precisely similar were there seen, evidently resulting from cutaneous perspiration. Strips of linen from the stained portions of the sleeves were digested in water. In 24 hours the stains were entirely removed, and the water in each tube had acquired a straw-yellow colour. The solution was wholly unlike that produced by blood; it was not changed in colour by ammonia, or by a heat of 212° F.; but it acquired a faint opalescence on the addition of nitric acid. These results indicated the absence of blood; the stains were due to perspiration. The man was acquitted on an *alibi*.

As regards the corroboration of these chemical tests which the microscopical examination can offer, it may be said that if red corpuscles *are*

found in sufficiently fresh and natural condition to be certainly recognized, there can be no doubt that the liquid is blood. Negatively there is this to be said, that none of the red fluids which might be mistaken for blood owe their colour to particles in suspension in any way resembling corpuscles, and heat applied to such a solution soon shows whether the colour is due to free hæmoglobin or not.

The spectroscope should be used as a routine test for final proof, for though there are many dyes which give absorption spectra which resemble one or other of the derivatives of hæmoglobin, there is no pigment which gives the specific spectra with the stated reagents.

Is it Human Blood?

When marks of blood have been detected on the dress of an accused person, it is by no means unusual for him to attribute the stains to blood from an animal which he had killed, such as a rabbit, bird, etc., or from the handling of fish. The question then arises whether we possess any certain means of distinguishing the blood of a human being from that of an animal.

It has been already observed that there are no definite chemical differences between the blood of man and animals. The hæmoglobin pigment, the albumen, and the fibrin are the same, so far as ordinary gross chemical and spectroscopical tests are concerned.

The medical jurist may determine this important point by the precipitin reaction which can be performed in the majority of cases. Occasionally an exclusion can be obtained by preliminary microscopy for cell shape.

MICROSCOPICAL EXAMINATION

Hairs, feathers, fish-scales, etc., embedded in a blood stain, may indicate its origin.

The Corpuscles. It must be recognized that it is only recent blood, the corpuscles of which have had no opportunity of drying, which can be submitted to this test with any hope of decisive information being obtained. The reason is that we have to rely upon three characters, viz., the shape, the size, the presence or absence of a nucleus, for our decision about the origin of the blood. When blood is dried on clothing, and it is necessary to extract the corpuscles by a solvent, we cannot rely on slight fractional differences in shape and size, since we cannot be sure that the corpuscles, after having been once dried, will ever acquire in a foreign liquid the exact size and other conditions which they had in plasma.

The microscope shows that the red cells of all mammals are circular biconcave discs excepting in the camel tribe, in which they are oval. They are all non-nucleated. The red cells of all other animals (Birds, Fish, Reptiles, etc.) are oval and all contain nuclei. In certain cyclostomes, e.g., the hagfish and lamprey, the red cells are circular biconcave nucleated discs.

The microscope, therefore, enables an observer to distinguish the fresh blood of birds, frogs, reptiles, and fishes, from that of a human being, and this may sometimes be of importance as evidence.

In R. v. Drury, it was suggested by the defence that the blood stains on the clothes of the accused had been caused by his having killed some chickens. The shape of the corpuscles negatived this part of the defence. In another case, the blood was alleged to be that of a fish; this was also disproved by the shape.

Bennet was called to see a patient who was alleged to be spitting fresh blood. On examining the sputum with a microscope, he found that the coloured blood-corpuscles were those of a bird. On his telling the patient that she had mixed a bird's

· blood with the expectoration, she was astonished, and confessed that she had done so for the purpose of imposition.

The chief microscopical distinction between the *blood of man and domestic animals* consists in a minute difference in the *size* of the corpuscles. This, however, is only an average mean difference, for the corpuscles vary somewhat in size in the blood of the same animal. In making use of this criterion, it would be necessary to rely upon the size of the majority of the corpuscles seen in a given area. Their size bears no relation to the size of the animal. Thus in the horse, ox, ass, cat, mouse, pig and bat, the red cells are about the same size; the difference is so slight as to be practically inappreciable. In these animals they are smaller than in man.

The corpuscles in man, the dog, the rabbit, and the hare are of nearly the same size. In the blood of the sheep and goat they are smaller than in most other mammalia. The size of the corpuscles bears no proportion to the age of the animal; thus in the blood of the human fœtus they are as large as in the adult. The size of the human red corpuscles varies from $6 \cdot 5$ μ to $8 \cdot 5$ μ. These measurements, however, have to be taken as an average, and the following table is only of value in indicating the average size of corpuscles of different animals.

Size 1 micron ("μ") = 0 001 millimetre.				
Of Circular Corpuscles.			*Of Elliptical Corpuscles.*	
			Short Diameter.	*Long Diameter.*
Elephant . $9 \cdot 4$ μ	Musk deer .	$2 \cdot 5 \mu$	Llama . $4 \cdot 2 \mu$	$7 \cdot 5 \mu$
Man . $7 \cdot 5$,,	Mouse .	$6 \cdot 6$,,	Pigeon . $6 \cdot 5$,,	$14 \cdot 7$,,
Monkey . $7 \cdot 5$,,	Hare .	$7 \cdot 1$,,	Frog . $16 \cdot 3$,,	$23 \cdot 0$,,
Dog . $7 \cdot 2$,,	Donkey .	$6 \cdot 3$,,	Triton . $19 \cdot 5$,,	$29 \cdot 3$,,
Rabbit . $7 \cdot 16$,,	Pig .	$6 \cdot 0$,,	Proteus . $35 \cdot 6$,,	$58 \cdot 2$,,
Cat . $6 \cdot 2$,,	Horse .	$5 \cdot 5$,,		
Sheep . $5 \cdot 0$,,	Cow .	$6 \cdot 3$,,		
Goat . $4 \cdot 25$,,				

Occasionally the microscopic examination of blood stains may give information of blood and other diseases and may show the presence of parasites.

In no circumstances whatsoever should a witness give any opinion as to whether a given blood is of human origin or not without undertaking one of the biological tests.

and showed that the precipitin reaction is excessively delicate in that a serum may react with a dilution of the protein as small as 1 : 100,000, and he subsequently worked out the method as a medico-legal test which has now become firmly established as the "precipitin test". It is essential that the test should be carried out by an expert in such matters, and it is now accepted that by it the origin of the blood can be determined with certainty. As pointed out, the precipitate can be obtained with infinitesimal quantities of serum or blood which need not even be fresh. Strictly speaking, the test is not a "blood test" but a specific protein test, so that proof of the presence of blood must first be established. From a forensic standpoint, therefore, the biological test involves:—

　　1. The demonstration of blood.
　　2. The demonstration of the species.

The demonstration of blood must first be carried out by means of chemical and spectroscopic tests, after which the source of blood (human or otherwise) is ascertained by the precipitin test.

THE TECHNIQUE OF THE PRECIPITIN TEST[1]

The production of anti-sera is carried out by the injection of rabbits with the defibrinated sera of different animals as required. For example, if it is required to obtain an anti-serum for human blood, the operator obtains a supply of sterile alum-precipitated human serum by collecting it from volunteer donors or from the freshly cut umbilical cord of a new-born baby. Coagulation is allowed to occur, and the clear serum is pipetted off into tubes, which are sealed and preserved on ice.

The experimental animal, usually a rabbit, is then prepared for the injection by clipping the ear fur and disinfecting the ear with ether. Intravenous injection into the marginal vein of the ear is the most efficacious and economical method.

The dose should not exceed 1·5 to 2 c.c. per kilogramme of the rabbit's weight. The dose is repeated every third day for three to five injections. Tests are made to obtain the titre of the rabbit's anti-serum by titrating a few drops against known dilutions of human serum. If a quick reaction with anything over 1 to 1,000 is obtained the animal should be bled by direct aspiration from the heart or by cutting its throat over a sterile dish (the skin surface having been first rendered aseptic by shaving and disinfection). After the blood clots the clear serum is pipetted off into 1 c.c. tubes and sealed. If refrigerated, these sera remain active for years. Many investigators prefer combined intravenous and intraperitoneal injections of serum. A dose of 1 to 2 c.c. is given intravenously and repeated after five to six days. This is followed by the injection of 5 c.c. intraperitoneally at intervals of four to five days for about three doses.

The Test. All sera[2] must be carefully examined before starting the test. A few drops of the anti-serum are added to 1 ml. of normal saline, and if no cloudiness appears within half an hour it may be considered satisfactory. It is then tested for potency by adding a few drops to a solution of 1 in 10,000 of related serum and should give a cloudiness within half an hour. It is

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[1] For details of the technique mentioned in these tests, consult "Recent Advances in Forensic Medicine", Sydney Smith and J. Glaister, Churchill, 2nd Ed., 1939, and Precom, II., 1943. *J. Path. Bact.*, 55, 419.

[2] Preferably ox-absorbed in order to measure specificity at lower titres.

then tested for specificity by addition to similar solutions of non-related bloods and should show no sign of cloudiness.

A solution of the suspected stain is prepared with normal saline and placed in an ice chest overnight. In the morning the pot is tilted carefully in order to allow the fluid to separate. The preparation is not shaken or manipulated more than is necessary, or otherwise a turbid solution may be the result. If the solution is cloudy a fresh preparation should be made before attempting to clear the solution by filtering, or by other means. If it remains persistently turbid it must be filtered.

The solution should be neutral and if found to be either acid or alkaline it should be neutralized by the use of a dilute solution of tartaric acid or of sodium hydroxide. A few drops of the clear solution are then run into a test tube and a few drops of anti-serum carefully run down the side so that no mixing occurs: the anti-serum runs to the bottom of the tube and a clean-cut line of demarcation can be seen between the two solutions. The tube, left at 37°C, for 20 minutes, is then placed in a rack in a special viewing box: light must be allowed to fall on the tube obliquely from above or below so that dispersion takes place at the junction of the two liquids. Within a few minutes a haziness appears at the junction and soon forms a definite ring if the test is positive.

A series of controls must now be set up, consisting of diluted samples of the stain, 1–500 to 1 in 10.000 approximately, a solution from an unstained part of the garment or other object, normal saline, a solution of rabbit serum, solutions of pure blood of man, ox, sheep, bird, or others as may be necessary, to each of which a few drops of anti-human-serum is added. A sample of rabbit serum is also tested with a solution of the stain.

If the stain is of human origin it should give a ring of precipitation successively less with the dilutions of the stain extract, a positive result with the human blood serum and with none of the others.

The test may also be carried out in capillary tubes. A number of freshly drawn, clear capillary tubes is prepared. A series of drops of anti-human-serum is then placed on a white tile. A small quantity of the stain extract is then run into a capillary tube, followed by an equal amount of anti-human-serum from one of the drops. Both solutions pass up the tube by capillary attraction.

The tubes are observed against a dark background, the top of the tube being tilted away slightly from the observer. If the stain contains human blood and the anti-serum is potent, a ring precipitate appears at the line of junction of the two liquids within a few minutes. The stain extract is then tried against a series of anti-sera (ox, sheep, bird, etc.) and against normal rabbit serum; the anti-human-serum is tried against known human serum, sera of certain other animals, and against normal saline for controls, and an unstained portion of the exhibit is extracted and tested against the anti-serum. If the solution of the suspected stain gives a positive reaction with the anti-human-serum, and with nothing else, the stain contains human albumen. *If no reaction is obtained with the anti-human-serum, the reverse is not necessarily the case,* for blood in certain conditions, and from the action of certain chemical substances, loses its quality of precipitation.

Kayssi[1] has published an interesting method for the precipitin test using pipettes instead of capillary tubes. The capillary ends of Pasteur pipettes are closed and the required number placed in a rack, the holes of which are

tissue could have been human by this test, and have used it in detecting albumen of different animals in many fabrications.

In *R. v. Haigh* (C.C.C., 1949) three gall stones were found in the acrid matter poured away from the 'acid bath' into the soil of a yard at Crawley, Sussex. Sufficient epithelial debris was present in the core of one which was opened to give a positive human precipitin reaction.

In *R. v. Ruxton* (Manchester Assizes, 1936) pieces of tissue recovered from the waste pipe of the bath, unrecognisable as human, gave positive human precipitin reactions after washing to eliminate contamination by soap. Cross-examination was directed to ensure that this precaution had been taken.

Space does not permit a description of many interesting features about this test, but the reader may obtain full details of the test in Smith and Glaister's "Recent Advances in Forensic Medicine",[1] or in Roche Lynch's original article in the *Analyst*, (1928) 53, 5.

Age of Blood Stains

This is a question that may be of vital importance. The answer to it depends upon the fact that when once blood has been shed and exposed to atmospheric and other influences its hæmoglobin is converted into meth-æmoglobin and hæmatin. These changes are well known and understood, but it is not clearly defined at what rate they take place under the varying influences to which the blood may be exposed. The more acid the air the more rapidly is the change produced, but this is not the only atmospheric factor that can effect the change, nor is it possible to state the amount of the acidity in the particular air to which any given stain was exposed. The physical change in a stain produced by these chemical processes is a colour change from red to reddish brown. This change of colour may take place in warm weather in less than 24 hours. After a period of five or six days, it is scarcely possible to determine even conjecturally the date of a stain from its appearance. In a large stain of blood on linen, no further obvious change took place during a period of 15 years. It had a reddish brown colour at the end of six weeks, which it retained for the long period mentioned. The stain may not be so readily dissolved by water, but no chemical test applied to the solution can enable a chemist to fix the date. Blood of one week's and blood of six week's date may present the same chemical properties and physical characters.

Spectroscopic examination does not take us any further. It will show the presence of oxy- or reduced hæmoglobin, methæmoglobin or hæmatin, but this is immaterial beyond the bare fact that we are not dealing with absolutely fresh blood if the spectra of methæmoglobin or hæmatin are present without preliminary treatment.

The rapidity with which the pigment dissolves in water and other liquids may constitute a basis for a medical opinion. It has long been known that the fresher the blood the more easily is the red colour dissolved in water; hence the suggestion that the age of the stain on linen and other stuffs might be fixed by the time required for the commencement and completion of the solution of the blood pigment.

On linen and other stuffs, the rapidity of solution must, however, depend on so many contingencies irrespective of age; for example, the quantity of the blood, the nature of the stuff, its thickness, and its permeability to liquid, that no definite rules can be safely laid down for determining the precise date.

[1] Smith, S., and Glaister, J., 1938. "Recent Advances in Forensic Medicine". London: Churchill.

· Is the Blood Arterial, Venous, Male, Female, Menstrual, Infant?

It is not possible to distinguish *arterial* from *venous* blood by any physical or chemical characters when it is in a dry state upon articles of dress, furniture, or weapons; but this, in medico-legal practice, is not often a subject of much importance, since there are few cases of severe wounds, either in the throat or other parts of the body, in which the two kinds of blood do not escape simultaneously. The most striking and apparent difference between them, when recently effused, is the *colour*, arterial blood being of a bright scarlet, while venous *blood* is of a dark crimson or plum colour; but it is well known that the latter when exposed to air for a short time, acquires arterial colour; and the two kinds of blood when dried cannot be distinguished chemically by any known test. The source may, however, be inferred (*vide infra*).

Recently a method of identifying male from female blood has arisen from a study of the nuclear form of the white cells.[1]

The blood of a child at birth forms a thinner and softer coagulum than that of an adult, and in the new-born many of the corpuscles are nucleated and exhibit greater fragility. There is a difference in the chemical behaviour of `foetal and form of adult hæmoglobin which enables their proportions in any fresh sample to be estimated.

A medico-legal question has arisen, on more than one occasion, as to whether there are any means of distinguishing *menstrual* blood from that of the body generally. The only differences noticed are: (1) that it may be acid (fresh blood is alkaline), owing to its admixture with vaginal mucus; (2) that under the microscope it may be mixed with epithelial scales, which it has derived from the mucous membrane in its passage through the vagina: and (3) it contains, as a general rule, large numbers of micro-organisms, whereas in an ordinary blood stain which has dried quickly there are few to be found. If menstrual blood does not coagulate, it is because it has already coagulated within the uterine cavity and has again become fluid, it contains fibrino-lysins,[2] as may the blood of those suffering from shock and other states; it is also more fluid than ordinary blood, because, during its trickling descent, it becomes mixed with uterine and vaginal mucus.

Did it come from a Living or Dead Body?

The physical characters of the blood marks may provide strong evidence on this point:—

The fact of the blood having come from the arteries of a living person will be indicated by its being scattered in a fine spray (from the spurting of an artery) over surfaces upon which it has fallen, while venous blood is always poured out in a continuous, not jerky, stream. These differences are constantly observable in every operating theatre. In most bleeding wounds, the blood is poured out simultaneously from arteries and veins.

A sprayed appearance of the blood, when it exists, will, *cæteris paribus*, create a presumption that it was poured out from a *living* body, for after the heart has ceased to act the arteries lose the power of throwing out the blood in jets. It must be remembered, however, that blood projected with force by swinging a blood-covered weapon or by any other means will produce a similar appearance.

This method of distinguishing the two kinds of blood, therefore, may only occasionally be available for practical purposes; it must also be remembered

[1] Davidson, W. M., and Smith, D. R., 1954. *Brit. med. J.*, 2, 6.
[2] Willson, J. R., and Numnell, E. R., 1946. *Proc. Soc. exp. Biol., N.Y.*, 62, 227.

that accident may lead to the sprinkling of blood from a small vein which has been wounded, while blood may be poured out in considerable quantity from an artery, especially if large; and if it falls on one spot at a short distance, it may produce a soaked appearance. The sprinkling may be expected only when the wounded artery is small, and the blood is shot to a distance. It should be distinguished with care from blood "splashed" out of a wound by repeated blows or flung radially away from some object like the hair of a twisting head, or a weapon in flight.

In 1931 a night watchman at the Hertford County Hall was beaten-up by an intruder who threw pepper in his face, then dealt him repeated heavy blows on the head with a jemmy or some similar weapon. In the struggle, blood was *splashed* from scalp wounds on to an adjacent wall, *flung up* in isolated spots over the ceiling, *dripped* to the ground and was *smeared* along the lintel of a doorway and *trodden* over the linoleum: a bloodstained hand had made an impression on a bannister at the foot of a stairway. Deceased's trail was clearly marked out, showing where he collapsed for a while, moved to a sink for water, *soiling the drain and towel*, and finally collapsed in a toilet behind the door slumping down the wall to the floor, still bleeding, though less owing to the severe losses already incurred.

At the trial at Salisbury of a woman in 1909, accused of the murder of her crippled son, Professor Pepper swore that on the sleeves of the blouse which she was wearing at the time of the assault were spots of blood which could not possibly have come there as a result of having a blood-stained knife thrown at her, but were from a small severed artery. The jury disagreed on the first trial; at the second trial she was acquitted even in the face of this evidence.

The size and direction of the spots vary according to the distance of the person wounded and the direction in which the spurting has taken place against the surface. When blood falls upon porous articles of clothing, as linen or cotton, it is absorbed, and produces a spreading stain. In dark-coloured articles of dress it is sometimes difficult to detect these stains, which may be more perceptible when photographed by filtered (infra-red) or reflected (ultra-violet) light.

Source of the Blood: Victim or Assailant[1]

It is not possible to identify beyond dispute the individual sources of a blood stain, owing to the existence of persons having identical blood groups, but if the victim and assailant are of different blood groups it should be possible to differentiate between the two bloods by serological tests. In certain extraordinary circumstances in which there is disease of the blood in one or the other, it is possible that information of value might be obtained, and in certain instances serological tests for a particular disease might provide an additional identity factor.

A general idea of the source, volume and direction of flow of blood may be obtained by study of the clothing worn by victim and assailant, and of the vicinity (*vide supra*). These assumptions should always be tested by grouping where there is any suspicion of foul play, a careful plan (or photography) being used to identify each stain.

Blood Groupings and its Medico-Legal Applications

The blood of human beings belongs to one of four principal groups. This follows from the fact that when the red blood corpuscles are suspended in

[1] See also p. 293, Blood Stains at Scene; p. 297, Blood Stains on Weapons; p. 298 Blood Stains on Assailant.

their own serum, or serum from a similar group, there is an even suspension. If, on the other hand, they are suspended in a serum of a different blood group, they eventually collect together in clumps. This phenomenon of clumping is known as agglutination, which is due to certain substances present in both the red corpuscles and the blood serum. The red corpuscles contain what is known as the agglutinogens (antigens), and the serum contains the agglutinins or anti-bodies.

Agglutination in the blood of humans was first noted by Landsteiner in 1901. He and his colleagues classified blood into four groups, now called A, B, AB, and O. Such groups are known as the ABO groups, and have been so named because it was shown that there were two primary agglutinogens or agglutinable substances, A and B, in the corpuscles, and two agglutinins, *a* and *b*, in the serum. These substances are disposed as follows in the four International groups—the older Jansky and Moss classifications having fallen into disuse:—

EUROPEAN FREQUENCY	GROUP (International)	SERUM	CORPUSCLES
* 46·7	O	Agglutinins *a* & *b*	NO agglutinable substances
41·7	A	Agglutinin *b*	Agglutinogen A
8·6	B	Agglutinin *a*	Agglutinogen B
3·0	AB	NO agglutinins	Agglutinogens A & B

* After Iken and her colleagues, 1939. Aust. Eugen Crab, 9, 409.

These agglutinogens are present at birth (*vide infra*): the infant agglutinins develop after birth.

The agglutinin *a* agglutinates only corpuscles containing the agglutinable substance, or agglutinogen A, and the agglutinin *b* only corpuscles containing the agglutinogen B. It follows, therefore, that the serum of Group AB persons will not agglutinate corpuscles from any group. The serum of Group A agglutinates corpuscles of Group B; the serum of Group B agglutinates corpuscles of Group A; the serum of Group O agglutinates the corpuscles of Groups A, B, and AB.

Conversely, Group AB cells are agglutinated by the sera of Groups A, B and O; Group A cells are agglutinated by the serum of Group B; Group B cells are agglutinated by the serum of Group A; Group O cells are not agglutinated by any of the sera.

With regard to Group A, it was first demonstrated by Dungern and Hirschfeld (1911) that there are two sub-groups, namely A$_1$ and A$_2$. These are also found in Group AB, giving rise to sub-groups A$_1$B and A$_2$B. The red corpuscles of sub-group A$_1$ absorb agglutinin *a* more completely than do those of A$_2$. The serum of Group B blood contains agglutinins *a* and *a*$_1$ respectively, and by absorbing this serum with A$_2$ cells, *a*$_1$ is obtained free from *a*. The agglutinin *a* agglutinates A$_1$, A$_2$, A$_1$B, and A$_2$B cells, whilst that of *a*$_1$ only reacts with the sub-groups A$_1$ and A$_1$B. More weakly reacting sub-groups A$_3$, A$_4$ and A$_5$ are known to exist, but are very rare. A$_3$ is perhaps found in one out of 2,000 persons, and one example of A$_4$ was found in 60,000 routine examinations.

In the United Kingdom the approximate proportions of the above groups and sub-groups are believed to be as indicated below:—

Group .	O	A	B	AB	A$_1$	A$_2$	A$_1$B	A$_2$B
Percentage .	46	42	9	3	35	10	2·5	0·5

In addition to the above A_1A_2BO blood groups, but entirely distinct and having no relation whatever with them, Landsteiner and Levine demonstrated that human blood can be divided into types M, N and MN. In type M (about 26 per cent) the corpuscles possess the agglutinogen M, but no N; in type N (about 24 per cent) the agglutinogen N is present but no M; in type MN (about 50 per cent) blood possesses both the agglutinogens M and N. No blood lacking both agglutinogens has been found, and the agglutinins anti-M and anti-N do not occur naturally in human serum. In 1947 Walsh and Montgomery discovered a related S-factor. A weak, and medico-legally, unimportant P-factor has also been recognized.

Another more recently discovered factor of great forensic importance is the Rh factor, or Rh agglutinogen or antigen, which is present in the red blood corpuscles in certain humans and absent in the case of others. Landsteiner and Weiner[1] (1940) found that when rhesus (monkey) red blood corpuscles were injected into rabbits or guinea-pigs an immune serum was produced, with which an agglutinable substance in human blood was detected. This substance was different from A, B, M, N or P. It was designated Rh, to indicate the use of rhesus in producing the serum. The anti-Rh agglutinin produced in the rabbit's serum by the injection of the rhesus red blood corpuscles agglutinates the blood corpuscles of about 85 per cent of human beings, these people being known as Rh-positive. The remaining 15 per cent of humans are Rh-negative, their red blood corpuscles having no Rh antigen. Rh is present before birth and is distributed—85 per cent positive, 15 per cent negative—evenly amongst the two sexes.

This factor has an important practical bearing on the etiology of hæmolytic disease of the newborn, and in unexpected reactions in cases where transfusion of compatible AB blood has been carried out.

An Rh-negative mother may receive Rh antigen from the fœtus through the placenta when the child is Rh-positive, the father having been Rh-positive. This Rh antigen produces Rh antibodies in the mother, who may thus develop hæmolytic reactions if transfused after the birth of the child with Rh-positive blood. Again, this anti-Rh agglutinin may pass from the mother by way of *the placenta into the fœtus which is Rh positive, and so the child may develop* erythroblastosis fœtalis, or hæmolytic disease of the new-born. When Rh-positive blood is transfused into an Rh-negative individual, that individual will produce anti-Rh agglutinin in his or her serum. Consequently, when a second transfusion from an Rh-positive donor is given at a later date, hæmolysis may occur with unhappy results to the patient.

The Rh factor, as detected by stock anti C.c.D.E. sera, has 12 major subtypes, some of which are very rare. It is a factor which may add to the data in cases of disputed paternity (*vide* p. 364).

Blood-Grouping Technique

Apart from their importance in transfusion, the blood groups play an important part in medico-legal investigations concerning the identity of blood stains, certain body fluids, and in cases of disputed paternity. These forensic aspects have been reviewed in some detail.[2]

With regard to stains, it may be necessary to try to prove whether the blood could have come from the accused or from the injured or murdered

[1] Landsteiner, K., and Wiener, A. S., 1940. *J. exp. Med.*, 74, 309.
[2] Keith Simpson, 1953. In Modern Trends in Forensic Medicine. London: Butterworth.

individual. If it can be shown that blood stains found in relation to the accused are of a different group from that of the blood of the injured or deceased person, then a positive answer can be given; whereas, if they are of a similar group, then this at the most can only be corroborative circumstantial evidence.

Blood stains are usually dry when they reach the laboratory, but, if they happen to be still moist, a piece of stain may be soaked in normal saline solution and the red blood corpuscles obtained in the soak can be tested with A and B sera. When the stain is perfectly dry, however, it is impossible to obtain corpuscles in a sufficiently good state to show agglutination, and therefore, different methods have to be adopted.

In the first place, an attempt may be made to identify the agglutinins in the stain. If a crust can be obtained, the method of Lattes[1] may be used. Small pieces of the crust are placed on three microscope slides, and to these is added a drop of cell suspension in 1 ml. of normal saline of known A, B and O bloods respectively. A cover glass is placed over each preparation, which is left for 30 minutes in a moist 37°C. chamber. They are examined under the low power of a microscope, and when a positive result is obtained, clumping of the corpuscles round the immediate vicinity of the crust will be seen. During the 30 minutes' interval it may be necessary to manipulate the cover glass with light pressure. Group O blood is used as control, as at no time should there be agglutination of these cells.

If the material is saturated with blood an extract may be made of it. About ½ sq. cm. of the stained material is soaked in a very small quantity of weak saline, being compressed from time to time with a glass rod or forceps. It should be left for an hour at room temperature, and then placed in the refrigerator overnight. It may be necessary to centrifuge the expressed liquid, which is then tested against 1-2, 1-4 and 1-8, etc., suspensions of A, B and O cells. Positive results only can be considered, as in a negative result it is possible that the agglutinin has deteriorated. For example, if A cells only are clumped and not B cells, the blood may be that of Groups B or O, but certainly not A or AB, since in O the b agglutinin may have deteriorated. If both A and B cells are agglutinated, but not O cells, there is no doubt that the blood belongs to Group O. Controls of the material should always be used in the above tests in order to eliminate the possibility of the presence of any substance, apart from the agglutinins, which might agglutinate red blood corpuscles.

A more reliable method of obtaining a group of a stain is that of absorbing the agglutinins in known sera by the agglutinogens which are present in the stain. In practice, the stain is frequently too small to allow for a satisfactory amount of agglutinin to be obtained from it. Again, the agglutinins deteriorate more rapidly than the agglutinogens, which, however, may, by prolonged drying, lose their capacity to absorb group agglutinins. Thus, when a stain fails to absorb an agglutinin, it does not always mean that the agglutinogen is absent; it may be inactive. On the other hand, there may be substances in the material on which the stain is present, such as body fluids, which contain group-specific substances which tend to mask the correct determination of the agglutinogen content of the blood stain. Other substances, apart from body-fluids, such as certain dyes, disinfectants, scents, etc., may also do this. Hence the very greatest importance must be attached to rigorous controls of the unstained material itself, taken from as near the

[1] Lattes, M., 1932. Individuality of the Blood. London: O.U.P.

stain as possible. This on no account must ever be omitted. It is useless to attempt this method without having access to control material.

The testing sera should be those of Groups A and B, arranged in 1-2, 1-4, 1-8, etc., dilutions. Group O serum has been recommended, but it is not always so satisfactory because the titre of the two agglutinins is often unequal. Also, it may be that, when one agglutinin is removed, this may involve some removal of the other. If there is only sufficient stain for one absorption, equal quantities of sera A and B should be used, in suitably decreasing concentration.

Each serum must be tested beforehand to prove its reliability and strength. A 1 in 2 dilution in normal saline should be used, and this further diluted by making progressively doubled dilutions up to 1 in 512. Each dilution is tested separately under the same conditions in which the absorbed sera are to be used. As the quantity of stain available for testing is frequently limited, the tests can be carried out in "well" microscope slides A_1, A_2 and B corpuscles should be used routinely throughout the test. The dilutions are made by means of drops from a capillary pipette, and, after they have been thoroughly mixed, an equal drop of the appropriate cell suspension in normal saline is added to each. After 30 minutes, during which the slides have been thoroughly shaken, the readings are taken through a low-powered microscope.

Both the sera having been thus tested, a small quantity of each (1 in 2) is slowly added to separate portions of the stained material in small test tubes. It will be found sufficient if four drops of the absorbed A serum, and five drops of the absorbed B serum, can be drawn off for the carrying out of this test. In the case of the stain itself, it is occasionally possible to scrape sufficient off the surface of the material. If the blood is well soaked into the cloth, the cloth should be cut into small pieces before soaking with serum. After thorough mixing, the test tubes are left at room temperature for an hour and then placed in a refrigerator overnight. The treated sera should again be left at room temperature for an hour before testing. It may also be necessary to centrifuge them. The depth of colour of the absorbed serum should also be observed, as this may assist in assessing the final results. Pieces of unstained material of similar size to the stained must also be put up in exactly the same way for control purposes. Finally, all the sera from the stained and unstained material should be titrated to extreme dilutions against A_1, A_2 and B cells, as has been described for the preliminary testing of the sera. If sufficient stain is available, the results from the use of human sera of Groups A and B may be checked by the use of absorbed immune anti-A and anti-B sera. This also makes the detection of A_2 stains easier.

There may be incomplete absorption owing to an insufficiency of the stain. The reduction of the agglutinin titre must be at least three places with regard to the a agglutinin, and two in the case of the b, before any significance can be attached to the readings. If there is a failure to absorb both the agglutinins, it does not necessarily mean that the blood belongs to Group O. There may not be sufficient blood present, or the agglutinogens may have deteriorated. An attempt should be made to obtain the agglutinins, as even if one, such as the a, only is detected, then these findings are practically diagnostic of Group O.

used.[1] The absorption method is also used for their detection. Test cell suspensions of M, N and MN groups taken from Group O individuals are essential.

Stains other than Blood. Body tissues and secretions also contain group specific substances. Those found in seminal stains, sweat, tears and saliva may be of *considerable importance in medico-legal work.* However, it must be remembered that only some 75–80 per cent of individuals have these group substances in their semen or saliva; individuals are known as "secretors" or "non-secretors", according to whether or not the group specific substances are naturally present. In the case of "secretors" the group can usually be readily established, as the group-specific substances occur in relatively high concentration, but of course in "non-secretors" they are absent. The absorption method, similar to that described for blood stains, is used, with 2 per cent suspensions of suitable red cells and similar rigid controls. When no absorption is found to occur, it has to be assumed that the material belongs to Group O, that the individual is a "non-secretor", or that there has been deterioration of the group substance. It may in some cases be possible to verify this by ascertaining the blood group of the suspected person. A close association exists between the Lewis blood system and "secretors": all L+ persons are "non-secretors".[2]

Nasal mucus stains also contain a ' large amount of group substance. Urine and fæcal stains have a low group substance content and a high salt content. Because of this they may give non-specific reactions.

These facts have to be remembered when one specific type of stain is apt to be contaminated by another. For example, blood from an assaulted individual may be contaminated by seminal fluid from the assailant. Blood or seminal stains on a handkerchief may be contaminated by nasal mucus. Sweat on garments which have been worn close to the body, or urine, may be a source of contamination. Consequently, the results of the groupings of such contaminated stains may be quite worthless.

Blood Groups and Heredity. The ABO, MN and Rh groups are hereditary factors, being inherited according to Mendelian principles. One of each of the antigens A, B or O is passed on to the child by each parent. O is now recognized as being not merely an absence of A and B, but is known to be a weak antigen. These factors are carried in "genes" which are present in the rod-like bodies, or chromosomes, which occur in pairs (there being 24 pairs) in the nucleus of every cell apart from the reproductive cells. In these reproductive cells (sperm and ovum) the pairs of chromosomes separate, so that the sperm from the male contains only one of each kind of chromosome (in all, 24 chromosomes) as does also the ovum of the female. When these cells unite in reproduction, the pairs are again established, one of each pair having been received from either parent. The human blood groups are inherited by such a mechanism. Bernstein (1924) showed that the three genes A, B and O form a series of triple allelomorphs. Rh inheritance is not sex-linked and follows a 6-pair allelomorphic antigenic pattern.[3]

A and B are both "dominant" to O, and O is "recessive" to A and B, whilst A and B are equally dominant. One of each of these factors must be contributed by the parent, so that the genic constitution of the offspring may be

[1] Race, R. R., and Sanger, R., 1950. Blood Groups in Man. Oxford, Blackwell.
[2] Grubb, R., and Morgan, W. T. J., (1949). *Brit. J. exp. Path.*, 30, 198.
[3] Fisher, R. A., 1944. Cited by Race, R. R., *Nature*, 153, 771.

AA, AB, AO, BB, BO or OO. This is known as the genotype. AA, the homo-
zygote, cannot be serologically differentiated from AO, the heterozygote,
and the same occurs with the genotypes, BB and BO, the serologically
demonstrable blood group (phenotype) in each case being A and B. In
addition, of course, there are the phenotypes AB and O.

If either of the factors A and B is present in the child's blood, it must have
been present in the blood of at least one of its parents. Thus:

When ABO tests alone are used the possible children are as follows:

$$\text{Matings} \begin{cases} O & \times & O & - & - O \\ O & \times & A & - & - O, A \\ O & \times & B & - & O, B \\ O & \times & AB & - & - A, B \\ A & \times & A & - & - O, A \\ A & \times & B & - & O, A, B, AB \\ A & \times AB & - & - A, B, AB \\ B & \times & B & - & - O, B \\ B & \times & AB & - & - A, B, AB \\ AB & \times & AB & - & - A, B, AB \end{cases} \begin{array}{l} \text{Possible} \\ \text{children} \end{array}$$

When A_1, A_2. BO groups are used some caution is necessary, though the
advantages in elaborating the phenotypes of possible children are great:

Matings	Possible Children	Matings	Possible Children
O × O	—	$A_1 × A_2$	O, A_2
O × A_1	O, A_1, A_2	$A_2 × A_2$	O, A_2, B, A_2B
O × A_2	O, A_2	$A_1 × A_2$B	A_1, B, A_2B
O × B	O, B	$A_2 × A_2$B	A_2, B, A_2B
O × A_1B	A_1,B	B × B	O, B
O × A_2B	A_2,B	B × A_1B	A_1, B, A_2B
$A_1 × A_1$	O, A_1, A_2	B × A_2B	A_2, B, A_2B
O × B	O, B	A_1B × A_1B	A_1,B, A_1B
$A_1 × B$	O, A_1, A_2, B, A_1B, A_2B	A_1B × A_2B	A_1, B, A_1B, A_2B
$A_1 × A_1$B	A_1, B, A_1B, A_2B	A_2B × A_2B	A_2, B, A_2B
$A_1 × A_2$B	A_1, A_2, B, A_1B, A_2B		

The factors M and N are inherited in the same way, being of course, entirely
independent of the ABO grouping. Moreover, an individual must have one
or other or both of the factors M and N; he cannot lack these factors, there
being nothing which corresponds to O. Both are of equal dominance. Each
parent supplies a factor. When both supply M, the homozygote MM results,
the child belonging to the group M. When both supply the factor N, the
homozygote NN results, the child belonging to group N. When one parent
supplies M and the other N, the heterozygote MN results and the child belongs
to group MN. An N child cannot come from an M parent, and vice versa,
an M child cannot come from an N parent.

The Rh-factor is also inherited as a dominant character. The gene Rh
determines its presence and the gene *rh* its absence. It has the same distri-
bution in both sexes, and appears to be quite independent of any other
blood group.

The S or "secretor" factor is another factor which appears to be determined
by Mendelian principles of heredity. As already mentioned, certain people
secrete the antigens A and B into the saliva, semen and other body fluids,
whilst others do not. The secreting type is the more common. The genes are

known as "S" (secretor) and "s" (non-secretor). It is inadvisable to use
this test when any of the persons concerned belongs to Group O.

Landsteiner and Levine produced sera which defined another property
in human blood, which was called by them agglutinogen "P". It would
appear that this factor is transmitted as a Mendelian dominant, an individual
either being P+ or P—. The lack of a regular source of potent anti-sera is
an obstacle in the application of this test in paternity cases.

The ABO, MN and Rhesus groups are most frequently used in cases of
disputed parentage, although the additional factors mentioned above might
be used when the opportunity presents itself. The correct diagnosis of the
M and N groups requires very great experience.

With regard to the ABO groups, the agglutinogens are always present at
birth, whereas the agglutinins develop in the first few months of life and
are fully established at the end of two years. The M and N factors are present
at birth, as is also the Rh factor. In testing a newly born child, it is probably
better to wait until the child is at least one month old.

The use of blood-grouping methods in the exclusion of paternity—or
rarely maternity—is achieving a tardy acceptance in English and in Scottish
Courts, whereas in the Scandinavian countries, in Germany and in some
North American States the practice has become an approved court procedure.
On the basis of the established genetic inheritance of specific groups, and
the impossibility of variation from this Mendelian trait, it should be possible
to exclude parentage in a varying proportion of cases according to (a) the
frequency of the groups under observation and (b) the number of factors
introduced into the test.

Using the ABO group sera only, the chances of exclusion are, at their
best (with the AB group), 1 in 2, and at their worst (in A) 1 in 17. Using MN
types in addition, about doubles the chance of proving the impossibility of
paternity.

In practice in Germany[1] the figures, over 4,220 cases, were:—

Examination for	Chances of exclusion estimated	Excluded (per cent)
O.A.B.	1/6	7·7
MN	1/6	8·6
Both	1/3	14·2

The further introduction of the Rh sub groups increases the general chance
of exclusion to about 1 in 2, and, if the rarer Kell, Lutheran, S and Duffy
groups were also tested, to as much as almost 2 in 3 (about 62 per cent).[2] It
must be remembered that use of the usual anti-D serum for Rh testing
can, of itself, do no more, than exclude a Rh+ child from a coupled Rh—
parentage—a 2·5 per cent event in whites, even less in negroes, who have a
rather higher incidence of Rh+.

In 1949, at a Scottish Sheriff Court, a man was charged with carnal knowledge of
a girl under 14 years of age who had had a child, allegedly by him. No conclusions
could be drawn from the ABO or MN tests, but Rh sub-group tests showed that the
baby's blood contained antigen C *which was absent from both the mother and the
alleged father.* The Sheriff warned the jury to assess the medical evidence with care:
they found the accused "Not Guilty".[3]

[1] Schiff, F., and Sasaki, H., 1932. *Klin. Wschr.*, 11, 1426.
[2] Race, R. R., and Sanger, R., 1950. Blood Groups in Man. Oxford, Blackwell.
[3] Rentoul, E., 1949. *Brit. med. J.*, 2, 1200, 1366.

In *Wilson v. Wilson* (1942) evidence was given that the husband's blood group was OM, the wife's BM and that of the child, whose parentage was in dispute, ABN. The Divorce Court accepted this as evidence that Wilson could not have been the father and granted a decree.[1]

The Danish High Court, in a judgment as early as May, 1933 (UfR. 1933, p. 824) pronounced the acquittal of a husband in a divorce case on the basis of exclusion according to the ABO tests *despite* his admission of intercourse with his wife at the time of conception.[2]

Andresen, from a vast experience in Copenhagen, points out the rarity of certain combinations – such as, for instance, A_2BN, Rh- P- non-secretor which is likely to be met with in only 1 in 40,000 cases—but even this finding could not *prove* paternity: it would merely make the alternative possibilities extremely remote. Blood tests, it must again be emphasized, can never *prove* paternity, any more than identity: they can indicate possible—or; at their strongest, exclude—paternity.

For further information regarding this subject, the reader should consult the following publications:

Blood Grouping Technic, by Schiff, F., and Boyd, W. C., 1942. New York, Interscience Publications.

Blood Groups in Man, by Race, R. R., and Sanger, R., 1950, Oxford. Blackwell.

Memorandum (M.R.C.), London: No. 19, by Mollison, P. L., Mourant, A. E., and Race, R. R. (1948).

The Human Blood Groups, by Andresen, P. H., 1952. Oxford, Blackwell.

[1] *Lancet*, 1942, 1, 570.
[2] Andresen, P. H., 1952. The Human Blood Groups, p. 91. Oxford, Blackwell.

CHAPTER XI

FIREARM WOUNDS

WOUNDING by firearms is dealt with under the following sections of the Offences against the Person Act, 1861:—

Sect. 14. "*Whoever . . . shall shoot at any person or shall by drawing a trigger or in any other manner attempt to discharge any kind of loaded arms at any person . . . with intent . . . to commit murder shall, whether any bodily injury be effected or not, be guilty of felony*".

Sect. 18. "*Whoever shall . . . by drawing a trigger or in any other manner attempt to discharge any kind of loaded arms at any person with intent . . . to maim, disfigure, or disable any person, or to do some other grievous bodily harm to any person, . . . shall be guilty of felony*".

Sect. 19. "*Any gun, pistol, or other arms which shall be loaded in the barrel with gunpowder or any other explosive substance and ball shot, slug, or other destructive material shall be deemed to be loaded arms within the meaning of this Act, although the attempt to discharge the same may fail from want of proper priming or from any other cause*".

Sect. 28. "*Whosoever shall by the explosion of gunpowder or other explosive . . . burn . . . or do any grievous bodily harm, . . . shall be guilty of felony*".

GENERAL DESCRIPTION OF WOUNDS PRODUCED BY FIREARMS

The recognition of firearm wounds though usually easy, is sometimes extremely difficult, for many types of injury are produced which have little resemblance to the commonly accepted characters of such wounds. This is particularly the case when high velocity weapons are discharged at close range, and in glancing wounds.

We should be able, from an examination of the wounds, to form some idea of the type of firearm and projectile that was used, the distance and direction of fire, and the number of shots that may have been fired. It is of obvious importance to ascertain whether the wound was suicidal in nature, whether it was self-inflicted for the purpose of deceit or for malingering, or whether it was accidental or homicidal. We should also be familiar with the more remote effects of projectiles—effects which may not be recognizable at the time, but which, at a later period, may lead to pathological conditions and various disabilities which are of the utmost importance in claims for compensation or pensions by the injured person, or grants to surviving relatives.

In many cases extraordinary wounds are caused by normal projectiles, especially those of high velocity, and for this and other reasons it is desirable that we should discuss the elementary features of such wounds.

The principle in all firearms is essentially the same. A charge of powder, black or smokeless as the case may be, is compressed in a cylinder. It is then ignited by percussion of a fulminating mixture in the cap. The ignition of the powder leads to the evolution of a quantity of gases at very high pressure

and temperature, and the expansion of this volume of gas forces out the projectile at a greater or less velocity. All bullet-firing weapons have the barrel scored internally by a series of spiral "lands" and grooves, and the forcing of the projectile into these grooves imparts to it a spin which will vary with the velocity and the inclination of the rifling.

Black powder is a mixture of sulphur, saltpetre and charcoal and is found as black grains, coarse or fine as the case may be, without any particular form. Nitrates, potassium sulphides and sulphates may be detected on close discharge, as well as small quantities of carbon monoxide. **Smokeless nitro-cellulose or nitroglycerine powders** show great variation. They may be in the form of fine or coarse flakes, discs, cylinders, or, in the case of cordite, in longer threads like chopped string, and the shape and form may be sufficient to identify them microscopically. Although called smokeless, they emit a certain amount of smoke, but never cause the same degree of blackening as with black powder. CO, CO_2 and hydrogen with varying proportions of nitrous gases are evolved upon discharge and, detection of the cherry pink of CO charge on the muscle of an entry wound may assist in its recognition as a close or contact wound.[1]

We have seen in the body of a Pole recovered from a pond several weeks after death, distinct CO colour changes over a radius of some 4 to 5 inches in the subcutaneous muscles around an entry wound over the mid front chest. Tests for CO were positive. This finding gave a clear indication of the wound being a contact discharge, almost certainly suicidal.

Projectiles vary enormously. In revolvers, as a rule, a simple bullet of hardened lead is used, but in all high velocity weapons, such as automatic pistols and rifles, the bullet is composite, consisting of a core of soft lead, or lead hardened by tin, arsenic or antimony, enclosed in a jacket of harder metal, such as copper, cupro-nickel, compounds of zinc and nickel, or, in some cases, steel. The Mark VII rifle bullet, as used by the British Army, consists of a lead core with an aluminium tip, the whole being encased in a cupro-nickel jacket; most other nations use a bullet with a soft lead core and cupro-nickel jacket; the Germans use a lead core with a soft steel jacket, and the French, until recently, used a solid copper and zinc bullet. Other types may be encountered, such as the armour-piercing bullet, which consists of a hard steel core enclosed in an envelope with a layer of lead between the core and the envelope. Tracer bullets are similar to armour-piercing bullets, but have, in addition, a quantity of barium peroxide and magnesium, or similar substances, enclosed in the base. The heat of the explosion ignites the mixture and the bullet becomes incandescent. Incendiary bullets containing phosphorous may be used and, in certain cases wounds may be found in which portions of these bullets are still hot and smoking in the tissues.

The shape of the bullet varies considerably. In revolver and automatic pistol ammunition the point is usually rounded or ogival, and the bullet is rather short. In all rifle ammunition there has been a tendency, in order to obtain sufficient weight with a limited cross section, to use elongated bullets with a pointed extremity. The body may be cylindrical throughout as in the Mark VII bullet, or streamlined as in the U.S.A. ammunition.

Now let us consider what happens when a weapon is discharged. When the cap is struck the mercury fulminate explodes by detonation and ignites the powder in the cartridge. The powder charge burns from its surface inwards and produces a large volume of gas, amounting to about 300 c.c. per

[1] Walker J. T., 1941. *Police J.*, 15, 67.

gramme of black powder or 1,000 c.c. per gramme of nitro-powder. As the
evolution of gas increases the cartridge case swells outwards, firmly sealing
the firing chamber and releasing its hold on the bullet. The pressure starts
the base of the bullet moving forwards. This produces a very slight degree
of mushrooming of the base of the bullet, and this "setting up", as it is called,
forces it into the grooves of the rifling and prevents the escape of gas, or at
least the escape of much gas, in advance of the bullet. Nevertheless there
always is a certain amount of gas which so escapes. The pressure of gas
increases until, in the case of the modern rifle, it amounts to about 20 tons, and
in the ordinary .45 revolver about 5 tons to the square inch. The bullet passes
out from the muzzle, the confined gas behind it gives a recoil thrust to the gun,
and the sudden expansion of the released gas causes the report. As it emerges
it is accompanied by a blast of highly compressed hot gas, particles of
unburnt powder, smoke, flame and fragments of metal, grease and wad or
disc matter. At short ranges all of these things are liable to cause some effect
on the body, and are extremely important to observe in connection with the
diagnosis of firearm injuries, the range and direction, the type of weapon,
and so on, as will be described later.

When the bullet leaves the weapon it is acted upon by a series of forces.
The most important is the forward movement, and the rate of this movement
varies with the pressure of the gas within the barrel. Revolvers in general
fire a bullet of low velocity, and in the case of the ·45 Webley this rate is
about 650 ft. per second. With automatic pistols the velocity is considerably
greater, varying from about 1,000 ft. per second to about 1,300 in the case
of the Mauser pistol. The muzzle velocity of the service rifle is a little under
3,000 ft. per second.

Rotation, or spin, is imparted to the bullet by the rifling of the the barrel,
and the rate of spin will vary with the velocity of the bullet and the angle of
the rifling. In the case of the service rifle, since the grooves in the barrel
make approximately one complete turn in 10 ins., it is obvious that the rate
of spin will be something over 3,000 revolutions per second. This spin keeps
the bullet point forward, on the principle of the gyroscope, but, at first, as
in all gyrating bodies, (for example, the ordinary spinning top), there is a
tendency to gyrate around the line of flight; that is to say, the base of the
bullet, instead of keeping dead straight, tends to wobble slightly. This
instability remains for a few hundred yards, *after which the spin keeps the*
bullet pretty accurately on the line of flight. As the velocity and spin diminish,
the bullet again becomes unstable, and at long ranges it may strike side-on.
The other factors acting upon the bullet and limiting its flight are air resist-
ance, which tends to cause also a certain amount of drift, and gravity, the
effects of which are to cause a parabolic flight line.

Two other movements of the bullet, tipping and turning, must be con-
sidered, and we must be prepared for this to happen at almost any range.
It is obvious that any elongated body, with its centre of gravity rather
behind the real centre, must be somewhat unstable in flight. Tipping or
turning may cause keyhole wounds of entry, or even lacerations, which may
have a very deceptive appearance.

Theoretically, the **wounding power of a missile** might be expressed in
terms of its potential energy, i.e., $E = \dfrac{WV^2}{2g}$ where E=the kinetic energy in
foot pounds, W=weight, V=the velocity, and g=gravity; thus the heavier
the bullet and the more rapid its flight the greater the wounding power.

Since the velocity is squared, it is obvious that velocity is the main factor, and in the evolution of the military bullet the striking power has been greatly increased by reducing the weight and increasing the velocity. Since, however, a certain minimal weight is required to inflict a sufficiently severe injury, and since it is undesirable to increase the cross section of the bullet, which would automatically increase the resistance of the air, the elongated pointed type of bullet has been evolved.

It is obvious that the potential energy is not the only factor to be considered in dealing with the wounding power of bullets. If a bag of sand were thrown at a door, the door would possibly be knocked off its hinges. If it were struck with a mallet, a panel might be staved in. If it were struck with a pointed object, a clean hole might be driven through it. In these three cases, exactly the same amount of energy might be used with very different effects, depending, other things being equal, on the area of the striking surface and on the cross section of the striking object.
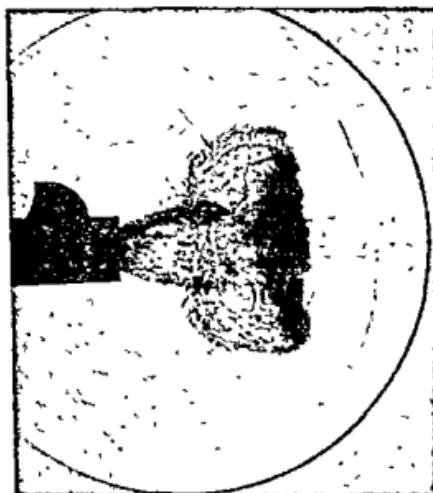
Fig. 30.   Photograph of a rifle at the moment of discharge, showing the mass of compressed gas and particles of powder. The circular wave is a sound wave *(Quayle)*.

Another factor of importance is the completeness with which the potential energy of the bullet may be converted into work. If a high velocity projectile with a small striking surface passes through the tissues without meeting with any special resistance, it may drive a clean hole without doing particular damage. It is quite possible for a bullet to pass completely through highly important organs without killing, and sometimes without stopping the person. It may drill a clean hole or a larger cavity through bone, and the hole of entry in the skin may be so small that it cannot readily be observed.

This is not always the case, however, for even when little resistance is encountered severe damage may result. When sufficient resistance is encountered to stop the bullet, as, for example, when compact bone is struck, the whole of the energy is converted suddenly into work, and extensive destruction may result, bone being comminuted extensively and soft tissues pulped.

The hydrostatic effect must also be considered. When a rapidly moving object strikes a fluid or semi-fluid medium, the force is distributed in all directions, and this may result in expansive bursting of the particular part, as well as damage to tissues and organs remote from its path. Blood vessels may be bruised and nerves and other structures severely concussed. Other remote results of the commotion may be seen in numbness at the part struck, which may be *temporary or permanent*, *paralysis from concussion of the cord*, or more or less severe injuries to the brain, although the bullet may not have entered. Blood vessels thus injured may later on be the seat of secondary hæmorrhage or of aneurysmal dilation. The bullet, moreover, imparts momentum to all particles of tissue which are struck, and such particles are driven in varying directions with varying velocity and may themselves act as secondary missiles.

The rate of the spin of the bullet is another important factor in dealing with its wounding power. A rifle bullet when it leaves the barrel is spinning at the rate of something over 3,000 revolutions a second, and also exhibiting "tail-wag". These terrific centrifugal forces are liable to radiate energy to all the tissues through which the bullet passes and produce severe and extensive damage simulating an explosion.
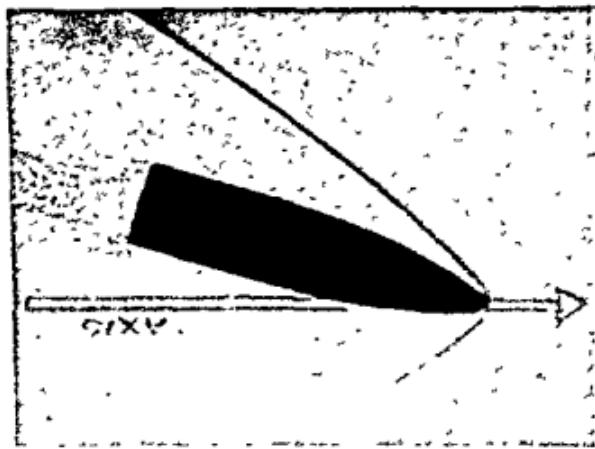
Fig. 31. High speed photography of ·303 bullet in flight showing "tail spin" around the axis of flight and a pressure wave due to this. (*Courtesy of Dr. B . E. D. Evans*).

The bullet may pass through the tissues. It may tip before it reaches the tissues, may enter broadside on, or it may turn around in the tissues and be found with the tip facing the entrance wound. This is comparatively common with all bullets. The bullet may "mushroom" or "set up", as it is called, and produce considerable laceration. Lead bullets are easily deformed if they strike a resistant object, but bullets enclosed in a nickel or steel jacket are likely to mushroom as a general rule when the jacket has been damaged or is deficient at the tip. Mushrooming occasionally occurs when particular obstruction has been met, even when the jacket has not been interfered with before firing. This effect is produced in some cases by interfering with the jacket, either by cutting or by boring a hole in the tip. Since the use of such bullets has been banned by international agreement, it is essential that no

opinion should be expressed about the use of dum-dum bullets without the most careful consideration.

The bullet may break into fragments, and it must be remembered that high velocity bullets fired at close ranges may fragment without striking any highly resistant body. This is most important, for there is a tendency to attribute this fragmentation either to explosive bullets or to deliberate damage to the cupro-nickel jacket.

In a series of experiments by one of us, with the Mark VII service bullet, .303 bullet, and the .300 (U.S.A.) service bullet, there were observed complete disintegrations of the bullet when firing into soft clay at ranges from 10 to 300 yards. This appears to be due to the velocity and spin, for in comparative experiments over the same distance into the same medium, with the same weapon and ammunition, but with charges of powder reduced no fragmentation of the bullet was observed. With low velocity weapons fragmentation is rare.

INTERPRETATION OF FIREARM WOUNDS

The interpretation of firearm wounds is made from the appearance of the entrance and exit wounds, the track of the bullet, and the presence of foreign matter in or around the entrance wound, in the tissues or in the clothing. These must now be considered in some detail.

Entrance Wounds. In the case of bullet wounds the entrance, unless the muzzle is in contact, is quite small; it may appear to be smaller than the missile owing to the elasticity of the skin, with the edges more or less inverted and bruised or lacerated. The edges of the wound commonly show a narrow ring of discolouration due to the removal of a layer of epithelium by the passage of the bullet and to soiling by graphite and oil. The surrounding skin may be scorched or not, and there may be a zone of blackening or peppering with grains of metal and powder, according to the distance from which the weapon was fired.

We must distinguish between near and more distant wounds. Usually when a weapon is discharged in contact with, or within an inch or so, of the body, the gases, including CO, which emerge with the bullet enter the tissues and thereafter expand, causing tearing of the skin or clothes, very often in the form of a cruciate or stellate split. Most of the powder is found inside the tissues, but there may be traces of blackening, burning, soiling and tattooing around the entrance hole. Infra-red photography may be used to detect this "halo" of marks when the use of a lens in ordinary light fails to do so. Hairs in the vicinity may be clubbed, swollen at intervals by heat, or burnt. If the weapon is discharged at more than an inch or two from the skin, the effect of the hot gases is lost and the entrance wound looks like a hole which might be caused by pressing a lead pencil into the tissues; it is rounded, with inverted edges, and surrounded by a zone of singeing, variable blackening from the smoke, and tattooing from the impaction of small particles of powder and minute traces of metal in the skin. If these are found in a compact zone around an orifice of entry it indicates that the shot has been fired within a few inches. As the range increases, dispersal occurs, the marks of burning are soon lost, and the tattooing from the powder becomes more discrete until no trace of powder marks can be found. In revolver and automatic pistol wounds nothing but the grease ring is likely to be found beyond about two feet; with rifles traces may be found up to three feet.

Care is required in examining for powder marks, especially in the case of a modern weapon, for smokeless powder is not black and may appear as small particles of gelatine or minute threads of flakes on the surface. Beyond some two feet nothing will be seen to indicate the range, and in deciding

FIG. 32. Contact entry of ·32″ pistol wound. The muzzle impression is unusually well marked.

whether it is an entrance wound or not, we have to be guided by the injury itself. All entrance wounds, if examined, will be found to have a zone of denuded epithelium immediately surrounding the orifice. This is caused by the spin of the bullet and the invagination of the skin by the bullet, and tends
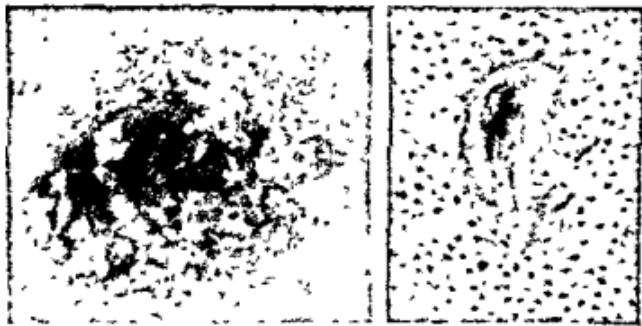
FIG. 33. Contact ·303″ service rifle wound, scorched, disrupted and slightly blackened entrance (L) and the "keyhole" exit (R) made by the bullet, which had struck the spine. The skin around the exit is stippled by blood left in the pores after washing.

to dry and become discoloured shortly after death. It should not be confused with the marks due to powder for it gives no indication of range.

The direction can be ascertained from observing the driving of fragments of clothing into the wound and tracing the course of the missile. When the

body is being dissected careful attention should be directed to the possibility of ricochet effects. An X-ray examination before dissection is often of great value in demonstrating metallic fragments along a bullet track. (See Fig. 39).

If the projectile traverses a bone the direction of fire may be ascertained from the difference in dimensions of the wounds of entrance and exit. Bone always tends to bevel at the point of exit owing to spread, and therefore the entrance is usually clean cut whereas the exit is bevelled in a cone-like manner.

The shape of the entrance is usually circular if the bullet strikes at right angles to the surface, but tends to become increasingly oval if fired at an angle until the bullet glances across the tissues, producing an injury similar to a cut or lacerated wound. The "smoke halo" is similarly shaped; it may be seen more clearly by infra-red photography.
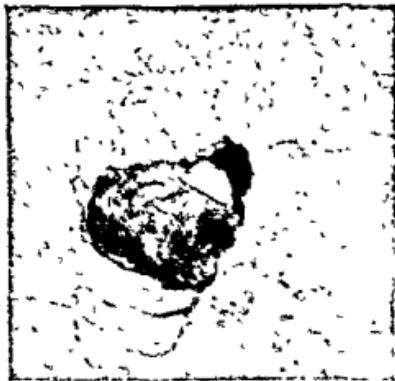
FIG. 34. ·88" lead bullet lodged inside R. parietal vault coming to rest in making exit. Extrication by any tool would be likely to damage the markings; released by breaking away bone.

number of wounds. If an odd number has been produced, it follows that the *missile must be still in the wound, and a careful search will reveal its presence.*

There are several important exceptions to this rule, viz. (*a*) when two are ordinary gunshot wounds and the last one a mere groove or graze, (*b*) a single bullet may split and thus produce one wound of entrance and two or more wounds of exit, and (*c*) in shot-gun wounds there may be only one wound of entrance and any number of exit, but these exceptions are so obvious as to require no discussion, for they should not in practice lead to difficulties.

A boy was found shot dead in a Guards Club at Westminster during the second world war. He had, it was found, taken a ·32 revolver from a holster in the cloak room and "was examining it at about waist level when it went off". An oval entry wound in the right cheek led to a disintegrated molar tooth in the right lower jaw from which *three tracks* could be traced. One from the crown of the tooth led up under the floor of the skull: a second from the bullet jacket, led up into the back of
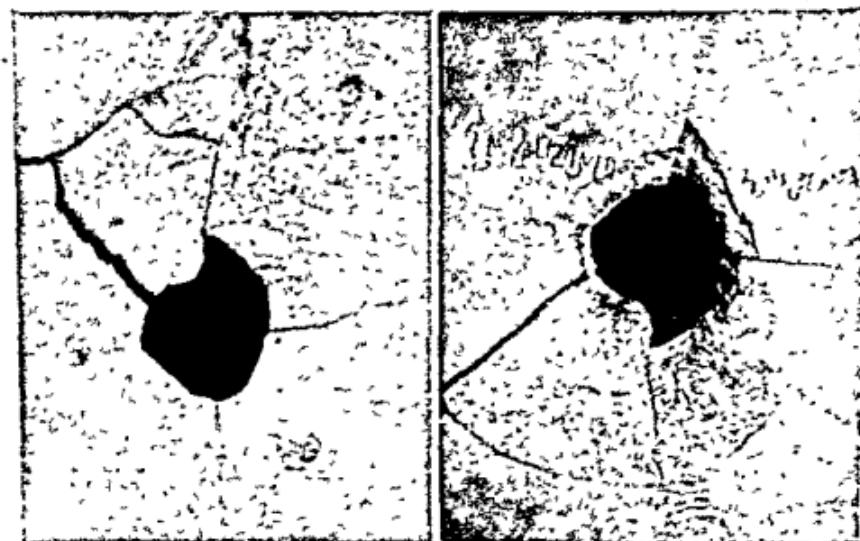
FIG. 35. Internal (*L*) and external (*R*) aspects of exit wound in top of skull made by ·38″ revolver discharge through roof of mouth. The bevelling which opens out with the course of the bullet is clearly shown.

the right orbit where the jacket was found: the third passed through the basisphenoid bone, traversed the brain stem and led to a point inside the left occiput where the bullet core was found flattened against the interior of the cranium. There were no exit wounds.

If the missile is found not in the body, but at the scene, this is a piece of circumstantial evidence to be weighed with the character of the wounds. It must, however, be remembered that this missile may not have been the cause of the wound.

If fragments of powder, or portions of the wad or projectile, are found in a wound they are conclusive evidence of the nature of the causative agent. Further discussion of them will be found below.

If only a superficial bruise or abrasion is found, it is impossible to say positively that a firearm caused it; but even with superficial glancing wounds, the

grooved appearance in the skin and the nature of the holes in the clothing and the spectrographic examination for metallic and other residues may enable the examiner to give an opinion on the matter.

Having decided that the wound is due to a firearm, the direction may be deduced from the position of entrance, exit and track, bearing in mind the possibility of deflection of the bullet and the different relationship of the parts of the body in movement. The range is estimated from the study of the marks of smoke, flame, or tattooing in wounds which are relatively close. When the range is greater, it can be estimated only approximately and with difficulty from the destructive effects and penetration.

As a general rule with revolvers and automatic pistols, there is no consider-

Fig. 36a. Cavity produced by firing a ·303 bullet into clay. The diameter of the entrance hole is about half an inch.

Fig. 36b. Cavity produced by firing a ·303 bullet into clay. The bullet never entered the block but struck the edge only. The same disruptive effect was produced.

able destruction of the parts. The case is entirely different however, with regard to rifle wounds.

The modern rifle fires a bullet with a velocity of about 3,000 feet per second, rotating at a rate of something over 3,000 revolutions per second. The bullet is kept point forward by the gyroscopic effect of the spin, but like a top tends to wobble somewhat at the beginning before it settles down. This continues for several hundred yards, and in dealing with wounds from rifles we must be careful to distinguish between those inflicted at relatively short ranges up to a few hundred yards, the middle ranges from 600 to 1,200 yards, and those at even greater range.

In the first group we are likely to see explosive effects; in the second group we are likely to see clean punctured through-and-through wounds; and in

the third group we are again liable to get irregular lacerated wounds, owing to the loss of velocity.

To illustrate the first group, if an ordinary ·303 bullet is fired into modelling clay free from all hard particles, it produces a fairly sharp hole of entry about half an inch to an inch in diameter, passes in in a cone-like manner for a few inches, then *suddenly smashes the material in all directions*, forming a cavity about a foot in diameter. The bullet itself commonly breaks up, sometimes into two or three pieces, sometimes into innumerable fragments. A portion of it may fragment and the rest pass forward, but practically never in a straight line. This disruptive effect occurs at any distance *within a few hundred yards*. The reason for such cavitation has been the subject of much discussion, and many observers have assumed that it is due to a pad of compressed air being forced in front of the bullet into the tissues. That this is not the case we have proved by many experiments—for example, by firing through a rubber sheet before the bullet enters the clay, by firing through two blocks of clay with an interval between (Fig. 36a), and by firing a bullet
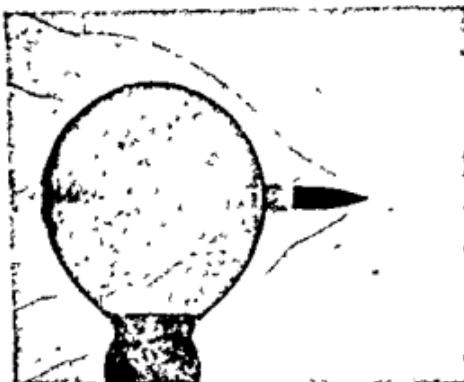
Fig. 37. Rifle bullet fired through a soap bubble (*Quayle*)

to strike on the side of a block of clay so that no balling-up in front of the bullet is possible (Fig. 36b). In all these experiments the same cavitation occurs.

The high-speed photographic recordings of bullets in flight show no compression pad of air in front, and when bullets are fired through a soap bubble (Fig. 37) no disturbance (which would occur if such a pressure pad were carried in front of the bullet) is seen. Experiments carried out with perforated lead bullets with a broad canal bored from tip to base show the same formation of a cavity when fired into clay as a whole bullet.

It has been suggested that the explosive effect is due to the bullet creating a vacuum behind it, with a consequent inrush of air to fill the vacuum. An examination of bullets in flight (Fig. 31) shows that there is a definite, but not extensive, commotion in the atmosphere behind the bullet, and there is no doubt that a negative pressure is produced when the cavity is formed, leading to an inrush of air. Photographs of the perforation of a soap bubble by a projectile show no deformation of the bubble such as would occur if a vacuum were produced. The experiment in which the edge of a block of clay has been struck, where no possible vacuum could occur, proves that this cavitation is not due to any such cause.

Experiments carried out in exactly the same conditions, in which the charge has been reduced to half or a quarter, thus cutting down both velocity and spin to the same amount, show that with the lower velocity and consequently diminished spin, less deformation of the medium takes place and the bullet is not disintegrated.

It is obvious that when a pointed object, travelling at the rate of about 2,000 miles an hour and spinning at something near a quarter of a million revolutions a minute and, at the same time, its base gyrating around its own axis, strikes moist tissue or any semi-diffluent medium, each one of the above-mentioned factors must set the tissues in motion, and as the bullet passes forward successive forces are set in motion producing a summation which causes complete cavitation.

Why fragmentation of the bullet should take place is hard to understand. There is a highly resistant jacket of cupro-nickel which one would not expect to rupture unless it struck a hard object; but this does not appear to be necessary, and we are drawn to the conclusion that the projectile disintegrates from the effect of its own centrifugal force. This explosive effect is a peculiar function of the clay, but the following cases show that similar effects are produced in the human body.

In one of our cases an escaping prisoner was shot from a distance of about 60 yards. The bullet entered the back, making an entrance hole that could be found only with difficulty, passed through the chest, making a ragged exit wound 4 ins. in diameter in the front of the chest. On dissection the heart was found to be completely disintegrated, smashed into minute unrecognizable fragments, and the bullet was also in pieces, although no resistant structure had been struck.

In another case a man was struck in the head, from a range of about 20 yards, by a service bullet. The top of the head was blown off and the bulk of the brain destroyed.

Another instructive case in which a soldier fired at a motor-car in the black-out during an air-raid alarm shows the disintegrating power of high velocity bullets. Only one shot was fired. The bullet passed through the celluloid window at the back of the car, entered the chin of the passenger on the right side, making a clean circular depression, and passed out of the left side, where it caused considerable laceration of the tissues.

The windscreen in front of the passenger was perforated in three places with holes similar in size to a ·303 bullet. In addition there were numerous partial fractures of the glass, and a distinct indentation in the metal rim of the screen. The aluminium tip of the bullet, with casing complete, was found on the back seat. Comparison of the tip with the oval indentation on the windscreen showed that the tip had ricocheted from the windscreen to the back of the car. The various marks on the windscreen were examined chemically and showed traces of lead and nickel. Numerous fragments of lead and nickel and minute fragments of skin were found on the floor in front of the driver's seat and round about the base of the windscreen.

X-ray examination of the lower jaw showed that the bone was smashed into fragments, amongst which there was found a particle of lead. The victim died a few days later from septic broncho-pneumonia, and the assailant was charged with murder.[1]

The number of shots fired was of prime importance. If more than one was fired then the case was obviously much more serious for the accused, and the number of marks certainly suggested that three shots had been fired. One shot only was heard, one cartridge case only was found and a reconstruction at the scene of the crime proved that more than one shot had certainly not struck the car. The appearance of the entrance hole showed that the bullet was complete when it struck the chin of the victim; a fragment

[1] Smith, Sydney, 1942: *Police J.* 15, 2.

of lead amongst the shattered bone showed that it had disintegrated after touching the chin, and the whole of the fragments were then projected with sufficient velocity to produce three exit holes in the windscreen and trafficator and numerous partial fractures of the triplex glass. The whole of these bizarre effects were produced by one bullet, giving an excellent example of the way in which an ordinary bullet may disintegrate in the tissues as if it had itself exploded as well as causing an explosive effect in the tissues.

A further example of this explosive effect is shown in the case of a young deserter who was shot from a distance of about 15 yards by a service rifle.
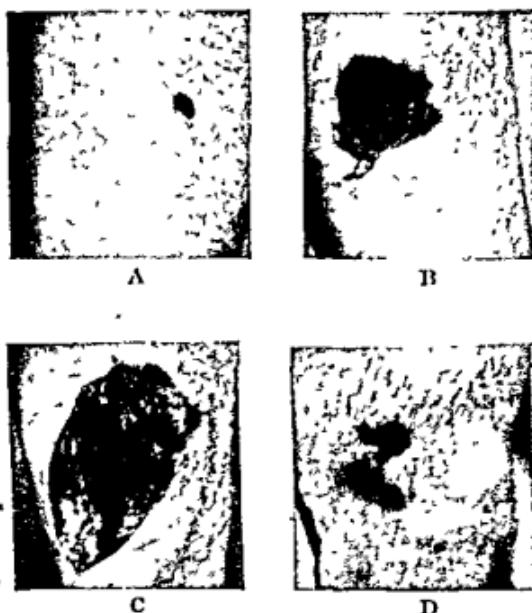
FIG. 38.

A, entrance in the left leg   B, exit in the left leg
C, entrance right leg   D, exit right leg

The bullet passed through both legs from left to right, and the victim died in about an hour from hæmorrhage (Fig. 38).

The hole of entry in the outer side of the left thigh was an ordinary clean-cut hole about ¼ in. in diameter (A). It traversed the fleshy part of the thigh passing below the femur, and made its exit on the inner side. The tissues were severely lacerated and the hole of exit was 2½ × 2½ ins. in size (B). The bullet then entered the inner side of the right thigh causing a lacerated injury 6 × 3 ins. in size (C), struck the lower end of the femur, smashed it into fragments, destroyed the femoral artery and nerve, and made its exit on the outer side, making a wound about 1 in. in diameter (D).

Innumerable fragments of the bullet were found in the tissues, showing that the bullet had broken up in the muscles before it smashed the bone. The remains of the projectile made its exit on the outer side of the right leg.

These injuries are strictly comparable with the experimental effects in soft clay and are due no doubt to the centrifugal force of the spinning projectile, causing explosive effects in the soft tissues and disintegration of the bullet.

In a large number of cases clean perforating wounds are caused and there may be extremely small entrance and exit wounds and comparatively little destruction in the track. These are most commonly found at ranges beyond

500 yards. With regard to through-and-through wounds of the head from which recovery may be complete, Freeman and Watts[1] quote a number of such cases, including through-and-through wounds of the left frontal region. Many of these cases made a complete recovery. Through-and-through wounds in the occipital region may cause temporary blindness.

Slorach reported a case in 1951 in which a depressed paranoid man was discovered by his wife eating his breakfast with blood trickling down from a wound in each temple. At 11p.m. *the previous night* he had shot himself with a ·38 inch revolver. He had got up in the morning, dressed himself, brushed his hair, and had cooked his own breakfast. He remained conscious. Radiology confirmed the entrance and exit wounds in each temple, and it was clear that the bullet had passed through the frontal lobes. He made a complete recovery, showing a retrograde amnesia of some

FIG. 39. Location of bullet (shattered by striking humerus) facilitated by X-ray. The transverse course taken in shown by minute fragments left in the tissues along the course of the (*unjacketed*) lead bullet. (*Courtesy of Dr. A. K. Mant*).

six hours. EEG was normal. He was discharged two months later and appeared much as he had been before, intolerant, unreasonable, bad tempered.[2]

Foxton also reported the case of a man found walking on to a hospital ship during the first world war with a through-and-through wound of the temporal lobes, "little the worse for his experience".[3]

There are other cases on record of perforation through various organs which might have been expected to cause certain death, but in which complete recovery took place.

Gilchrist[4] quotes the case of a man who received a wound with impaction of the bullet in the heart; he returned to civil life, and has to date been free from any obvious infirmity. We have notes of a similar case of a man who was wounded with a rifle bullet in 1917 and who has since carried on his normal

[1] Freeman, W., and Watts, J. W., 1942. Psychosurgery. Springfield: Thomas.
[2] Slorach, J., 1951. *Lancet*, 1, 1349.
[3] Foxton, H. V., 1947. *Med. J. Aust.*, 2, 615.
[4] Gilchrist, A. R., 1929. *Brit. med. J.*, 1, 723.

work; and another case of an individual who is at present apparently in perfect health with a rifle bullet embedded in his brain.

On the other hand, injuries may be caused by projectiles which do not lead to any immediate disability but in which disability occurs after a period of years; for example, Mutel[1] records a series of cases of men wounded in the head during the 1914–18 war in which the first complaint was not made until 7, 13, 16, and 17 years after the injury, and in which fragments of foreign bodies embedded in the brain were observed by X-rays. Foreign bodies in the brain may be particles from a projectile which passed through the skull without the injury having been observed, or scalp wounds, in which the projectile has struck at a tangent, and, without entering, has driven portions of the inner table into the brain. Cases such as these may show few symptoms, for the tolerance of the brain to foreign substances is very remarkable indeed, but there is always a chance of neurological effects supervening after long periods, and it is essential that this possibility should be borne in mind.

In other cases a bullet may pass through the body and inflict a glancing wound on an artery. Healing may be complete and no particular symptoms observed for many years afterwards, when an aneurysm may be found to have developed in the area of damage.

In a case of sudden death examined in 1953 at Guy's Hospital a man of 53 was found to have died of rupture of an aneurysm of the aorta. It was not an ordinary aneurysm. A small round orifice in the left wall of the ascending aorta gave access to a large saccular swelling largely filled by aged laminated clot lying under the arch in front of the left bronchus. In it there was found a round lead ball such as was loaded in the coarse shrapnel of the 1914-18 war. A scar lay on the back of the left shoulder: there was no exit wound. Enquiry showed that he had been pensioned for a shrapnel wound on the left chest in 1916, but had not, in fact suffered any ill health as a consequence. He had worked as an office clerk without complaint until, some 35 years later, he said he felt tired, became giddy, collapsed and died.

Many other secondary effects may be produced, as has been mentioned above, from the sudden pressure and commotion of the bullet, and if these possibilities are kept in mind it will prevent injustice being done to the individual in many cases.

TIME OF INFLICTION OF THE INJURY

Like other wounds, a firearm wound undergoes no marked change for an hour or so after its infliction. Our judgment in reference to this question may depend upon an assessment of the gravity of the wounds and the blood that has escaped, although we cannot always infer from the quantity of blood found near to a body that the bleeding was an immediate consequence of the wound, or that the whole of the blood was effused at once. It would be unwise to affirm that the deceased could not have moved or exerted himself in some degree after receiving it. The exertion thus made subsequently to his being wounded may have actually caused the fatal bleeding.

If the wound were something over ten or twelve hours standing, its age must be judged on general surgical principles by the extent of haemorrhage, swelling, vital reaction, etc.

WAS THE VICTIM ALIVE WHEN SHOT?

It is by no means easy to answer this question, unless the bullet has injured

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[1] Mutel, M., 1935. *Ann. Med. Lég.*, 15, 421.

some vessel, when the effusion of blood and the formation of coagula will indicate that the person was living when it was received. If a firearm wound has been produced in a dead body, little or no blood will be effused unless the bullet strikes a large blood vessel.

The question is, however, hardly relevant; for if in ordinary wounds, when a murderer may be frenzied, or a suicide half-hearted, it seems futile to ask who but a murderer would injure a dead body. *a fortiori* there is still less reason to ask the question who would shoot a dead man.

If a firearm wound be found on a dead body together with other wounds, it might be of importance to know which wound caused death. This, like many other points, can only be judged by general principles, such as the nature of the wounds, the parts injured, the amount of hæmorrhage, etc. (*vide* pp. 231–246).

IS THE WOUND DANGEROUS TO LIFE?

Very definite and significant differences are found between wounds from high velocity weapons and those from ones of low velocity.

In the 1914–18 war there were thousands of cases in which bullet wounds of soft tissues, and even of the bones, were followed by practically no symptoms whatever, and the soldiers were frequently able to return to duty in a very short time after bullets had traversed regions usually considered dangerous.

A soldier was standing on a rock, when suddenly his foot slipped, and he fell some few feet on to his shoulder. He was treated for "Contused shoulder." He could not return to duty for some weeks on account of considerable paralysis, the apparent result of the contusion. On careful examination it was subsequently found that a bullet had passed in at the mouth through the palate, thence through the base of the skull and through the brain at its base, and out by the occipital bone.

There were numerous instances of perforations of the lung, liver, kidney, bowels, stomach, intestines, etc., wounds usually considered very dangerous, if not even necessarily fatal, but in which rapid recovery ensued. It is quite clear that very extensive damage may be done internally without there being much external evidence of it.

All firearm wounds are dangerous to life, first from shock, secondly, from laceration of a large blood vessel or important viscus, such as heart, brain, liver, etc., and thirdly from the effects of sloughing, hæmorrhage, extravasation of the contents of a hollow viscus, infection, etc. Absorption of metallic or other poisons is a remote and insignificant risk.

So long as the missile remains in the body there must be a certain amount of danger, although there are numbers of cases on record in which the patient has led a normal useful life in spite of the fact that he had a bullet embedded in his tissues. Danger must be taken to be in some degree proportionate to the inaccessibility of the missile, coupled with its proximity to an important organ which could be damaged either by inflammation or by the shifting of the missile, or could have been slightly damaged at the time, with increased opportunity therefore for further mischief.

An inquest was held at Fulham on the body of a man who died as the result of a sudden attack of "epilepsy" and who three years previously had been shot in the head. On the *post-mortem* examination it was found that death was due to septic meningitis due to the bullet wound.

In another case a patient with a bullet wound of the abdomen suddenly died

after seven days' illness. At the necropsy a retro-peritoneal lesion of the abdominal aorta was found, with enormous hæmorrhage.

As a general rule a wound from a firearm which is not immediately fatal is more dangerous than one from a knife or bayonet or similar weapon.

Instances of firearm wounds proving fatal after a year and a day are not infrequent, and they demonstrate the inconsistency of limiting the legal responsibility of an assailant according to the period at which death takes place (*vide supra*).

AT WHAT DISTANCE WAS THE FIREARM DISCHARGED?

In a large number of cases this has proved to be a very material question; it is by no means an easy one to answer definitely.

In general we depend on the observations, already described, of the effect of compressed gases, the burning, blackening and-tattooing and their extent in any particular case. At ranges greater than a few feet even tattooing is no longer present and we are guided only by the effects of the projectile on the tissues and clothes as has already been described.

In the case of **shot-guns** the distance from which the weapon was fired may be deduced from the amount of scattering of the charge. Up to about a yard the whole of the charge enters in a mass, producing a round hole about the size of the bore of the weapon, with ragged edges and, for the first few inches, surrounded by a zone of blackening and burning.

As a rule there is little evidence of scorching beyond a few inches, but blackening of the edges of the wound and of the tissues surrounding it together with a gradually widening halo of tattooing may be found up to a yard. Beyond one yard and up to about three, a few particles of powder grains may be found on careful search.

The charge of shot which enters as a single mass begins to disperse after two to three yards with an ordinary cylindrical barrel (non-choke). Beyond this distance dispersion gradually widens; seen first as a few isolated groups of shot around the main entrance hole, it gradually widens in area until a separate pattern is observed.

Speaking generally the diameter of dispersion in inches will be found to be about one and a half times the distance in yards. With choked barrels the dispersion is, of course, considerably less. With pistols loaded with shot the dispersion is very much greater owing to the short length of the barrel.

These figures are given as a working basis, but it must be remembered that the dispersion varies with different weapons, with the nature and quality of the powder, the ignition and the method of filling or loading.

Both the clothing and skin of a person who has received a firearm wound should be closely examined. The result may be that the statement given of the mode in which a wound was received will be entirely disproved.

deceased, and not at a distance, since there were the marks of powder and burning on the wrist. Hence it followed that the pistol had not been discharged at a distance, but during a scuffle, more likely as said either by accident or in self-defence. The prisoner was acquitted, and the parties who had appeared as witnesses against him were convicted of perjury.

Wounds and Marks from Wad, Powder, etc. A gun loaded with a wad, or even with gunpowder only, may cause death. In these cases a disruptive force results from the explosion, and the discharge becomes a dangerous projectile. The lighter the projectile, the shorter the distance to which it is carried; but when discharged near to the body, even gases may produce a fatal penetrating wound. A portion of the clothing may be carried into the wound, and lead to death, either from mechanically wounding a vessel or organ or from later sepsis. Fatal accidents frequently occur from persons discharging guns or pistols at others in sport—an act which they think they may perform without danger, because the weapons are merely loaded with "blank" catridges".

In *R. v. Race* the prisoner killed the deceased by discharging at him, within a few feet, a gun loaded with powder and paper wadding. The deceased fell and died in a few minutes. It was found that the chest was penetrated, and that the wadding had wounded the left auricle of the heart. A girl was killed by a boy, who discharged at her a gun loaded with paper pellets. Some of these penetrated the body and lodged in the lungs and liver. Dupuytren mentions an instance where, during a quarrel between two men, one discharged at the other a gun loaded with powder and wadding only at a distance of about 18 inches. The man instantly fell dead. On inspection his clothes were found torn, the intestines were lacerated, blood was effused, and the wadding was lodged in the abdomen.

A man, sitting in the gallery of a theatre at Brighton, had a half of one hand completely blown away by a piece of greased newspaper, tightly rammed, discharged from a small cannon on the stage of the theatre.

Persons attempting to commit suicide have occasionally forgotten to load the weapon with a projectile. Nevertheless, the discharge has sufficed, from the effect of the wad and of gas pressure, to produce considerable destruction of parts, and to cause serious loss of blood. It is not easy to say at what distance a weapon with a blank charge would cease to cause serious hurt, since this must depend on the impulsive force given by the charge, and on the type of weapon.

A case occurred in the United States involving the question as to the distance at which a pistol *not* loaded with ball would suffice to produce a serious wound.

A boy in play discharged a pistol at a companion, producing on the fleshy part of the left hip a wound 1 inch in diameter and 4 inches in depth. The skin was destroyed, and the muscles were a blackened lacerated mass. There was no ball in the pistol, but it is not certain whether there was wadding. Death took place from tetanus on the seventh day, and on examination no wadding was found in the wound. There were, however, grains of gunpowder, with which the wound was blackened throughout its whole extent. At the inquest witnesses differed respecting the distance at which the pistol was held when the wound was inflicted. Some said 1 foot, others 2 or 3 yards. The deceased had stated his belief that the pistol had almost touched him, and, judging by the state of the wounded parts, this was probably the truth.

Swift contended that the wound had been produced by gunpowder only, without wadding. He performed some experiments with the pistol used by the prisoner, but loaded with gunpowder and *wadding*, in order to determine the effect of the discharges at different distances. At 12 inches distance from a body he found that the clothes were lacerated and the skin abraded, but the wadding did not penetrate; at 6 inches the clothes were lacerated, and the wadding penetrated to the depth of

half an inch; at 2 inches the wound produced, which was 2 inches deep, was ragged and blackened; at 1½ inches from the chest the wadding passed into the cavity between the ribs, and in a second experiment it carried away a portion of the rib.

The following case of unlawful wounding further illustrates this point:

R. v. Isgate. The prisoner fired at a boy with a gun loaded with brown paper, pressed together, from a distance of 2 or 3 yards. There was *a wound in the chest* about the size of a shilling. The margin of the wound was jagged, had a bluish black or mottled appearance, and the edges of one of the ribs were laid bare. The paper pellet took a course downwards, as a result of a deflection of the projectile by the rib. A quantity of brown paper was removed from the wound, and the boy ultimately recovered.

The question whether paper wadding could really produce such a wound as was here found when the gun was fired from a distance of *two or three yards* was investigated by Mackintosh. Without going into details, it may be stated that when the gun was charged with a small quantity of powder and brown-paper wadding there was indentation, but no penetration at a distance of two yards. With one-third more powder and a brown-paper pellet closely compressed, there was penetration through the boy's jacket to an inch and a half beyond. These facts confirmed the boy's account of the distance from which the gun was fired at him by the prisoner. Swift had inferred from his experiments that a penetrating wound from wadding was not produced unless the weapon were discharged within a distance of six inches; but Mackintosh's results show as might be expected that this depends on the quantity of powder used, and the loose or compact nature of the substance employed as a projectile.

Powder Marks. A portion of the powder always escapes combustion at the time of discharge, and then each grain then acts like a minute projectile, contusing the skin, producing ecchymosis, and often lacerating it if the weapon is fired at a close range. The clothing is burnt, and the skin *scorched* from the flame formed by the combustion of the powder; many particles of gunpowder may be actually driven into the skin, causing "tattooing".

Powder marks are more profuse and more easily seen when black powder is used. Smokeless powders are more completely burnt, and leave, as a rule, less deposit. The grains being colourless are less easily detected, and may entirely escape observation unless a hand lens is used. In general we may consider that marks of burning, of blackening, or of tattooing from powder grains indicate that the weapon was fired from a near distance, almost certainly within arm's reach.

HOW WAS THE WOUND INFLICTED?

This question is as a rule somewhat easier to answer in the case of firearm wounds than in ordinary wounds. It may be of considerable importance to ascertain whether the deceased received the wounds while standing or lying down, while running away or approaching; the relative position of the deceased and assailant and the line of fire. The points which may help in the solution of the problem are:

The evidence of eye-witnesses.

The situation and nature of wounds of entrance and of exit.

The direction of the track which joins the wound of entrance either with the missile, a point of deflection, or the wound of exit.

Evidence derivable from a multiplicity of wounds.

The Evidence of Eye-witnesses. This is, of course, extremely variable in quality both as regards reliability and clarity, even where there is no object in concealing the truth. As the report of a firearm can always be heard even in the midst of the loudest quarrel, it is more probable that the attention of those near would be immediately attracted than in the case of the use of a knife or other silent weapon. Not only would attention be thus drawn to the firing of the weapon, but the details of the occurrence would also be more likely to be thereby fixed on the memory. If there are witnesses of the occurrence their evidence is generally very direct. In the following case, for instance, no difficulty arose on this score:—

> Pong Lun was charged with having murdered Go Hing. A quarrel arose, and the prisoner left the room, returned, and directly afterwards fired two shots at the deceased and two more outside the room. The revolver, a five-chambered one, was picked up, and four spent and one live cartridges were found in it. Witnesses deposed to all the movements of the prisoner and to the manner of the shooting. The bullet that caused death had passed through the abdomen, injuring the intestine, kidney, and pancreas. These injuries had caused peritonitis as well as a severe loss of blood. The prisoner was found guilty, sentenced to death, and hanged. His counsel pleaded for a verdict of manslaughter, but the judge overruled this on the grounds: (1) That the prisoner had deliberately gone out of the room to fetch the lethal weapon. (2) That he was not so drunk as to prevent him from understanding the nature of his act.

The Situation and Nature of the Wound of Entrance. It is, of course, obvious that the position of the wound of entrance marks a part of the body which was at the moment of discharge facing the muzzle of the weapon, and in a straight line with the barrel; it therefore indicates with precision whether the victim was facing the muzzle or with his back or side to it, except in the case of a ricochet of which there may or may not be evidence.

> In *R. v. Boyce* (C.C.C., 1946) a woman was found dead sitting in a chair in a living room in Chester Square, London, facing a telephone on a desk. She bore a small calibre bullet entry wound in the centre of the nape of the neck; the track of the bullet ran almost horizontally forward to emerge on the face just to the right of the right nostril. A discharged ·32 in. calibre Eley shell-case lay on the carpet to the right of and several feet behind the chair in which the dead woman sat, and a ·32 in. calibre automatic bullet with six right hand grooves of Browning type lay spent at the foot of the wall towards which she faced. No tattooing was found on the skin or adjacent clothing. She had clearly been shot from behind at a range of several feet. The shell-case proved to be a vital clue in the conviction of Boyce for this murder.[1]

Where the weapon is set at a slant to the body the bullet may strike the skin and enter through a distinctly oval hole, the "approach" side of which is a graze widening out into the actual entry, or it may tear across the surface of the skin leaving only a groove or split.

A ricochet entry is often ragged since the bullet has, by the time it strikes the body, become distorted by its primary impact, tilted or spun, and lost much of its initial velocity; fragments of paint or wood may have been carried in with it, or still adhere to the bullet lying spent in the body.

> In *R. v. King* (C.C.C., 1953) a man was plainly crouching or bending very low with his back to his aggressor at the time he was shot, for an entry wound lay at the back of the chest, an exit over the heart, and a through-and-through wound lay in the right thigh; all four wounds could be brought into line by bending the trunk on the thigh. Only one shot had been fired.

Direction of the Internal Wound. Speaking in broad, general terms, the missile fired from a firearm has a tendency to continue in a straight line

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[1] Simpson, K., 1949. *Police J.,* 22, 32.

from the point of entrance to the point of lodgment, to a point of *deflection* or the wound of exit, so that, if the internal wound be straight, this straight line indicates the *direction in which the barrel of the weapon was pointed when fired*. But it must be particularly noted that very frequently this wound is *not straight*, but curved, the missile being deflected from its original course even by slight obstacles.

From the above rule it follows that if a person be shot in an erect position, and a wound be found nearly transversely through the chest, the firearm was certainly fired from about the level of the shoulder, a position which may have important bearings as to intent, accident, or homicide. Again, two fixed points where a ball has touched a *building* without being deflected, will determine the *direction* from which the weapon was discharged.

In a case at Ayr several shots had been maliciously fired into a church. Some of the bullets traversed a window, making holes in the glass, and *struck against* a wall on the other side of the church—a fact plainly indicated by the marks which they left. A straight line carried from these two points reached a window on the opposite side of the street, from which it was afterwards ascertained the bullets had been fired.

In another case a similar piece of evidence clearly showed that a gun loaded with a bullet had been maliciously discharged with a design to kill one of two persons. The prosecutrix and her mother were sitting by candlelight one evening near a window in their house, so that their shadows were projected on the blind; a bullet passed through the window and struck the wall of the house inside. A line drawn between these points was about half an inch over the head of the prosecutrix, and about 1 in. below the level of her mother's head. Neither was hurt. The prisoner was connected with the act by his having been seen near the spot, and by a variety of circumstances. It was alleged in defence that the prisoner had gone out with his gun in the evening to shoot birds with bullets, and that the piece had been discharged by some accident. The judge directed the jury to consider with what intent a shot could have been fired so as to come within half an inch of the head of a person. The prisoner was convicted.

In judging of the *direction* taken by wounds which traverse the chest from front to back, it is necessary to remember the great difference that exists in the level of the same rib anteriorly and posteriorly. This must be especially attended to when one is called upon to state the direction of a traversing wound from the description of it given by another. Reference to an articulated skeleton or to coarse frozen sections will facilitate accurate reconstruction.

A person died from a single pellet of small-shot traversing the chest from before backwards. The pellet entered between the first and second rib anteriorly, and traversing the lung, caused death by lacerating the sixth intercostal artery, near its origin at the lower edge of the sixth rib, posteriorly. In giving an opinion on the direction of this wound, one medical witness described the wound behind as being 6 ins. below the level of that in front. As the small track through the lungs could not be discovered, he was inclined to think that the two wounds could not be connected, because the gun had been discharged from the shoulder when the party firing was nearly on a level with the deceased. This opinion, however, was soon corrected by a reference to the anatomical relations of the frame of the thorax. Indeed, it will be found that a straight line carried backwards from between the first and second ribs in front will, in a well-formed skeleton, touch the upper border of the fifth rib posteriorly; therefore this wound was nearly *horizontal*—being only 1¼ inches lower posteriorly than anteriorly.

In the case of Colonel Fawcett, killed in a duel, the bullet entered on the right side of the chest, fracturing the *seventh* rib, and after traversing the posterior part of the lungs lodged in the *ninth* dorsal vertebra. These parts are in a line with each other, and the wound was horizontal.

those of the chest, and in its central part it will traverse the diaphragm.

When attempting to deduce the position of the assailant from the direction of the wounds, the observer must always keep in mind the possibility of the body having been in an abnormal position at the time of fire, thus a person stooping may be shot in the back with the direction of the wound from above downwards by a person standing in front of him.

When a bullet traverses the body it sometimes happens that the two apertures are opposite to each other, although the bullet may not have taken a direct course between them, but have been variously deflected by the subjacent soft parts. This deflection of a projectile from a rectilinear course is met with in those cases in which it strikes obliquely a curved surface, and it is found that when it enters and does not pass out its course is often circuitous, so that it is not always easy to say in what part of the body it will be found.

Taylor once saw a boy who had received a firearm wound in the upper part of the abdomen; the entrance orifice was plainly situated there, but there was an opening at the back, nearly diametrically opposite, out of which the ball had passed, so that it conveyed the impression that the ball had completely traversed the abdominal cavity. There was, however, no indication of serious injury, and Dupuytren gave an opinion, which was afterwards verified, that the ball had not penetrated, but had been deflected, and had taken a circuitous course through the cellular tissue to the back. Abernethy was called to examine a man who had shot himself through the head. He found two openings in the scalp, nearly opposite to each other. It was soon perceived that the ball had not penetrated the bone, but had followed the curve of the exterior of the skull to its point of exit.

A deflection of projectiles may occur not merely when they come in contact with bone, but when they meet skin, muscles, tendons or membranes. A bullet which entered at the ankle has been known to make its exit at the knee; and another, which entered at the back of the left shoulder, passed around the inside of the scapula and was found below the right ear. This deflection of a bullet by slight obstacles has been ascribed partly to the obliquity with which it strikes, and partly to the rotary motion on its axis. The modern small-bore rifle bullet has a much greater tendency to preserve its course, but there are many published cases which indicate that deflections are frequent, and in a series of experiments by one of us, deviation of high velocity rifle bullets in soft clay was found to take place quite frequently.

When a bullet from a high velocity weapon disintegrates the constituent particles are commonly deflected at various angles.

Evidence from Several Wounds. When several wounds are found on a body, can we determine whether they were produced by one or several different discharges, or how they were produced? This question has often been raised in cases in which there were two wounds on the deceased, and the accused alleged that only one shot had been fired. One bullet may sometimes produce several wounds on the body. If the bullet splits up within the body and divides itself into three or four pieces, there will be only one orifice of entrance, but possibly several orifices of exit. This splitting of a bullet has repeatedly occurred when the projectile in its course has encountered an angular surface, or a projecting ridge of bone.

Dupuytren met with an instance in which a bullet, after having struck the ridge of the bone of the leg (tibia), divided into two parts, which traversed the calf of one leg, and penetrated into the calf of the opposite leg. Thus no fewer than five wounds were produced in one instance by a single bullet—three of entrance and two of exit. A similar effect was observed in a case in which the bullet struck

the parietal bone of the head and divided into two portions: One passed out superficially through the skin; the other penetrated into the brain, and lodged on the tentorium.

Such cases show that the discovery of an exit aperture does not always prove that the whole of a projectile has passed out—a matter which may influence both medical opinion and treatment.

Figs. 40—42 illustrate a case in which one discharge caused fracture of both bones of the forearm, fracture of the upper third of the humerus and an injury to the tissues of the chest wall. The shot was fired at the moment

Fig. 40. Photograph to show the position of the victim at the moment of fire with arrow heads to show the position of the skin wounds.

Fig. 41. X-ray photograph of the wrist of Fig. 40 showing the damage caused to both bones of the forearm.

Fig. 42. X-ray of the shattered upper arm and chest wall of the same case.

when the victim was raising his right arm. Figs. 41 and 42 show the extent of the injuries to the bones.

Excellent illustrations of such multiple wounds have been published. In one such case[1] a ·303 rifle bullet struck the jaw of the victim, after which it disintegrated causing a number of fractures of a motor wind screen, licence holder and trafficator of the car in which the victim was seated. In another case[2] a young soldier received firearm wounds of all four limbs from one bullet from a Lewis gun fired whilst he was adjusting his puttees. Other examples of the diverse effects of high velocity weapons are given in the articles quoted.

The following case indicates how the presence of several wounds on the elbow showed conclusively how the shot was fired:—

Two children, a boy and a girl, were by themselves in a workshop where a loaded shot-gun was kept; the boy was five, the girl a little older. The gun was heard to go off, and the little girl came running out of the shop. The gun was found on the floor

[1] *Smith, Sydney, 1942. Police J., 15. 2.*
[2] *Idem, 1942, Ibid, 15. 4.*

some 6 feet or more away from the boy, who lay dead on the floor; the muzzle was towards him and the butt away from him. No reliance at all could be placed on the girl's story, which was coloured by fright and fear of the consequences of what she might say. Suicide and deliberate homicide were out of the question, and it was left to the medical evidence to clear up how the boy had been killed. Autopsy revealed some half-dozen small wounds made by the shot above the right elbow, entering just below the right elbow and running obliquely through the muscles up towards the upper arm; also a very large jagged wound in the neck just below the jaw, shattering the second and third cervical vertebræ, in which were lodged a large number of shot. Collectively these wounds showed conclusively that the girl must have pointed the gun at her little brother; that he in alarm put his right arm in a bent position to shield himself; the girl had then pulled the trigger, possibly unintentionally, and the elbow being a little out of the direct line of the bulk of the charge had received only a few pellets, the greater portion going under the arm and entering the neck. The girl had probably only about sufficient strength to hold the gun not quite to the shoulder, but being taller than the boy, the shot had taken a practically horizontal direction in him. Entire absence of marks of powder, coupled with the balling of the shot, showed that the shot was probably fired about two feet or a little more from the boy's head. Measurements at the scene of the occurrence closely corroborated this view.

WAS IT ACCIDENT, SUICIDE, OR HOMICIDE?

In firearm wounds the evidence is derived from the sources already discussed in reference to wounds of an ordinary character, but it is in some respect more definite in its indications. one reason being that the nature of the weapon is seldom in dispute.

The following case from previous editions of this work is well worth insertion as a special demonstration of the difficulties in deciding the point. and how they may be rendered insuperable.

In *R. v. Smith*, it appeared that the deceased was found dead in a field on the morning of November 20th. The body was lying at full length on its left side in a ditch. There was a blackened entry wound in. and a little blood on. the cheek. A pistol was lying on the ground about 4 feet from the head of the deceased. The time at which death took place was fixed with tolerable precision at twenty-five minutes before eight o'clock on the evening of November 19th. The prisoner had had an opportunity of being on the spot at the time when the discharge of the pistol was heard. The defence was that this was an act of suicide. The pistol could not be identified as belonging to the prisoner; and one witness for the defence gave evidence that, six years before, he had sold to the deceased a pistol resembling that found near the body. Upon this statement, and upon the failure of the medical evidence to throw any light upon the important question of homicide or suicide, the prisoner was discharged on the Scottish verdict of "Not Proven."

The wound was in the right cheek, below the malar prominence; the opening was blackened, and the nose scorched with gunpowder. It appears that the medical witnesses did not see the body until after the lapse of *two days*. It had in fact been removed from the spot, washed, dressed in grave-clothes, and put into a coffin, before they saw it. The situation of the wound —*i.e.,* below the malar prominence in the cheek— is unusual for an act of suicide, but it was such as a murderer walking by the side of the deceased could have easily selected. There was no motive for suicide, and no reason why, had suicide been contemplated, the deceased should have selected the prisoner's field for perpetrating the act. Every fact tended to prove that this was an act of homicide, and not suicide; the accused had the motive, means, and opportunity for committing the crime, but there were no circumstances which could directly connect him with it. The early interference with the body, and the failure to call for full medical investigation, resulted in the loss of parts of the evidence which would have clearly satisfied the jury that this could not have been an act of suicide.

The facts of such cases are to be reconstructed from :–

Circumstances showing the design;

The situation of the wound or wounds;

the ear. No slugs or bullet could be found; the direction was from behind forwards and from above downwards. According to this man's statement, the pistol missed fire three times, but he succeeded in discharging it into his mouth at the fourth attempt. He lost a large quantity of blood, but after some time he walked to a table at a distance of 5 yards, reloaded the pistol, and discharged it at the back of the head in the situation described. There were in this case, thus, two wounds, one of them being apparently homicidal in its characters; and there was a power of locomotion after the first wound in spite of a great loss of blood.

Evidence from the Proximity of the Weapon when Fired. Self-inflicted *accidental* firearm wounds bear the characters of near wounds as a rule; they may touch vital parts, but if the body has not been disturbed the presence or absence of design in the infliction of a wound is commonly made apparent by the relative position of the body and the weapon. Such an injury may occur when a person is cleaning a gun or pistol with the muzzle pointed towards him, and the wound is then situated in front; or it may be produced by a person pulling a loaded gun towards him through a hedge or dragging it after him. In the latter case the wound is behind, and may strongly resemble a homicidal wound, although the circumstances in which the body is found generally suffice to explain the matter.

Fig. 43. Suicide by .45 revolver. The site is one of classical election for suicide, and the muzzle has been pressed into the skin, the force of discharge splitting the tissues away from the skull. (*Courtesy of Dr. A. K. Mant*).

If a near wound be inflicted by a second person it may be impossible, in the absence of evidence, to say whether it was accidental or homicidal. It is very necessary in such cases to compare the particulars of the wound very carefully with the statements made by the person implicated; they may be such as to contradict in a most definite manner the evidence thus offered.

The weapon will usually be found to have been pressed against the body in the case of suicides, unless there is evidence of special design, such as a

long string or stick; the wound is almost sure to be ragged and blackened or peppered with fragments of powder, etc. In the following case the reason for acquittal is not very clear, having regard to the evidence that the wound was not a near wound:—

R. v. Wilson.—A medical student was charged with shooting at his father, a medical man, with intent to murder him. The prosecutor was lying asleep on a sofa in the evening, when he was suddenly awakened by a report of firearms and the sensation of an acute burning pain in the eye. This was followed by another report. A bullet was subsequently extracted from the eye, and another from the head. He fell off the sofa, and in raising himself up found a revolver on the floor at a short distance in advance of him. The prisoner had shortly before this gone downstairs in the direction of the room where his father was lying asleep. The prisoner called to his sister, saying that his father had shot himself. The medical evidence clearly showed that this was not such a wound as would have been produced by an attempt at suicide. *It had none of the features of a near wound.* The prisoner was, however, acquitted of the charge.

In the following case a verdict of manslaughter was narrowly avoided:—

At an inquest held on the body of a young man, it was stated that deceased and a friend had been shooting together. According to the friend's evidence, the deceased got over a fence, and slipped in climbing a bank and thus shot himself. The marks of slipping, however, were made by an unnailed boot, whereas those of the deceased were heavily nailed; the pellets in and about his head were 30 in number and the distribution of the pellets was such as might have been caused by the firing of a gun at a distance of 16 yards, at which distance the friend said he was when the accident happened. The verdict was to the effect that the deceased was accidentally shot by a gun not held by himself.

Proof of proximity is of very little value in evidence taken by itself; it must be weighed with all the other factors.

Evidence from the Position of the Weapon relative to the Body.— Due allowance must be made for the unusual conditions in which the body of a person who has committed suicide by firearms may be found, otherwise erroneous suspicions of foul play may be formed.

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Evidence from the Position of the Weapon relative to the Body.

Due allowance must be made for the unusual conditions in which the body of a person who has committed suicide by firearms may be found, otherwise erroneous suspicions of foul play may be formed.

A man was found dead on the floor of his bedroom, his body stretched out at full length, and both arms lying straight close to the sides of the body. A pistol-case was at a short distance from his right hand, and the left was gently closed on a piece of burnt paper without any blood on it, and the insides of the fingers were blackened. The pistol was lying near the *left* hand. On the right temple there was an entry wound. Portions of brain and blood had been carried to the furniture beyond the body. A conical bullet was found *within the body, resembling* those in the pistol-case. This appeared to be an act of suicide. If the pistol had been discharged with the right hand, then how did it happen that the pistol was lying near the left hand on the left side of the body, while the right arm was stretched at full length on the right side of the body? It is probable that the man shot himself with his right hand while sitting on the floor; that the pistol dropped on his left side, and that he fell flat on his back, his arms falling limp by the side of his body. The burnt paper and the blackening of the fingers remain to be explained, but strengthened the belief that the wound was right handed.

In these cases, as in cases of murder, there are many mysteries which can only be unravelled by the person committing the crime. Such a case as the above might have easily given rise to a charge of murder. The case of Risk Allah will furnish an additional illustration.

A young man named Headly was found dead in his bed. Really was subject to epileptic fits. Risk Allah had insured the deceased's life for £1,000, but it was in order to cover a loan which he had made to him. The facts, as they transpired from an official inquiry, were these: One morning the deceased had an

long string or stick; the wound is almost sure to be ragged and blackened or peppered with fragments of powder, etc. In the following case the reason for acquittal is not very clear, having regard to the evidence that the wound was not a near wound:—

R. v. Wilson.—A medical student was charged with shooting at his father, a medical man, with intent to murder him. The prosecutor was lying asleep on a sofa in the evening, when he was suddenly awakened by a report of firearms and the sensation of an acute burning pain in the eye. This was followed by another report. A bullet was subsequently extracted from the eye, and another from the head. He fell off the sofa, and in raising himself up found a revolver on the floor at a short distance in advance of him. The prisoner had shortly before this gone downstairs in the direction of the room where his father was lying asleep. The prisoner called to his sister, saying that his father had shot himself. The medical evidence clearly showed that this was not such a wound as would have been produced by an attempt at suicide. *It had none of the features of a near wound.* The prisoner was, however, acquitted of the charge.

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Evidence from the Position of the Weapon relative to the Body. Due allowance must be made for the unusual conditions in which the body of a person who has committed suicide by firearms may be found, otherwise erroneous suspicions of foul play may be formed.

epileptic fit, and Risk Allah, a medical man, having attended to him, left him to sleep. At seven o'clock on that morning the chambermaid had gone into the deceased's room and had seen him asleep. At 7.30 Risk Allah came downstairs, went out, returning just before nine o'clock: when the landlord said that, as they had neither seen or heard anything of Readly since his fit, Risk Allah had better go and see how he was. The bedroom door was found fastened on the inside, and there was a strong smell of gunpowder smoke issuing from the keyhole. The door was broken open, and it was found on entering that furniture had been placed against it, and the room was full of smoke. A table and chair were found overturned. The deceased was lying on the bed, shot through the head. The right arm was across the stomach, and the left arm by his side. A recently discharged gun and a ramrod were on the floor by the side of the bed, and there was a chair close by, which had been overturned. Some shots were also found. On a table in the room was a piece of paper on which were written, in the handwriting of the deceased, the words "I have done it," the ink being still wet. The question was raised whether this was an act of murder or suicide. Risk Allah was discharged, and the act was pronounced to be one of suicide. Three years afterwards the whole case was gone into again in this country, on the occasion of an action for libel, in which the writer substantially charged Risk Allah with the murder of his companion, and a verdict, with heavy damages, was returned for the plaintiff.[1]

There was nothing in the *medical* circumstances of this case which justified a charge of murder.

In relying upon the relative position to the deceased of a discharged gun or pistol, an expert, unless he has had a large experience in such subjects, may be easily deceived, and draw a false conclusion.

A gentleman was out shooting with a double-barrelled gun. He had just put on the percussion-cap, and was holding the gun loosely in his hands, when the right barrel went off. From the recoil, with nothing behind the butt, the gun flew back a yard or two behind him, and the cap of the left barrel came so sharply in contact with the hard ground that it also exploded, sending the charge into the outside of the sportsman's thigh. The shot passed through the right-hand pocket of his shooting-jacket, striking his shot-bag, and driving the brass top into the muscles behind the hip-joint. The metal head of the shot-bag deflected the charge, so that it passed round outside the thigh and lodged in the muscles. This deflection probably saved his life, as no great vessel was wounded.

Had the man been found dead in these circumstances, it might have been said that suicide and accident were impossible, that no man could have shot himself with a gun from behind in the manner described, and that the position of the gun, one or two yards behind the body, could only be explained on the supposition that someone had shot the deceased from behind.

In *R.* v. *Adams*, the prisoner was charged with the murder of his father; the wound which had caused death was situated at the back of the head. No weapon was found near; hence there could be no doubt that this was an act of murder. The prisoner was acquitted, since, although he was seen running from the spot at or about the time of the murder, another gun was heard to be discharged from the same spot about an hour afterwards; and it was impossible, from a medical examination of the wound to say at what particular time it had been caused.

There is, however, one position in which a weapon may be, which admits of very positive deductions, that is when the weapon is still *firmly* grasped in the hand of the dead man. This position proves most positively that, if the fatal bullet was fired by that weapon, the dead person fired the fatal shot himself (*vide* "Cadaveric Spasm"), but it does not of course prove whether he did it accidentally or intentionally; that must be left to other evidence to prove.

The absence of the weapon was of importance in the following case:—

[1] *Risk Allah* v. *Whitchurch*, Q.B., June, 1868.

long string or stick; the wound is almost sure to be ragged and blackened or peppered with fragments of powder, etc. In the following case the reason for acquittal is not very clear, having regard to the evidence that the wound was not a near wound:—

R. v. Wilson.—A medical student was charged with shooting at his father, a medical man, with intent to murder him. The prosecutor was lying asleep on a sofa in the evening, when he was suddenly awakened by a report of firearms and the sensation of an acute burning pain in the eye. This was followed by another report. A bullet was subsequently extracted from the eye, and another from the head. He fell off the sofa, and in raising himself up found a revolver on the floor at a short distance in advance of him. The prisoner had shortly before this gone downstairs in the direction of the room where his father was lying asleep. The prisoner called to his sister, saying that his father had shot himself. The medical evidence clearly showed that this was not such a wound as would have been produced by an attempt at suicide. *It had none of the features of a near wound.* The prisoner was, however, acquitted of the charge.

In the following case a verdict of manslaughter was narrowly avoided:—

At an inquest held on the body of a young man, it was stated that *deceased and a friend had been shooting together.* According to the friend's evidence, the deceased got over a fence, and slipped in climbing a bank and thus shot himself. The marks *of slipping, however, were made by an unnailed boot,* whereas those of the deceased were heavily nailed; the pellets in and about his head were 30 in number and the distribution of the pellets was such as might have been caused by the firing of a gun at a distance of 16 yards, at which distance the friend said he was when the accident happened. The verdict was to the effect that the deceased was accidentally shot by a gun not held by himself.

Proof of proximity is of very little value in evidence taken by itself; it must be weighed with all the other factors.

Evidence from the Position of the Weapon relative to the Body.— Due allowance must be made for the unusual conditions in which the body of a person who has committed suicide by firearms may be found, otherwise erroneous suspicions of foul play may be formed.

A man was found dead on the floor of his bedroom, his body stretched out at full length, and both arms lying straight close to the sides of the body. A pistol-case was at a short distance from his right hand, and the left was gently closed on a piece of burnt paper without any blood on it, and the insides of the fingers were blackened. The pistol was lying near the *left hand.* On the right temple there was an entry wound. Portions of brain and blood had been carried to the furniture *beyond the body.* A conical bullet was found within the fender, resembling *those in the pistol-case.* This appeared to be an act of suicide. If the pistol had been discharged with the right hand, then how did it happen that the pistol was lying near the left hand on the left side of the body, while the *right arm* was stretched at full length on the right side of the body? It is probable that the man shot himself with his right hand while sitting on the floor that the pistol dropped on his left side, and that he fell flat on his back, his arms falling limp by the side of his body. The burnt paper and the blackening of the fingers remain to be explained, but strengthened the belief that the wound was right handed.

In these cases, as in cases of murder, there are many mysteries which can only be unravelled by the person committing the crime. Such a case as the above might have easily given rise to a charge of murder. The case of Risk Allah will furnish an additional illustration.

A young man named Readly was found dead in his bed. Readly was subject to epileptic fits. Risk Allah had insured the deceased's life for £1,000, but that was in order to cover a loan which he had made to him. The facts, as they transpired from an official inquiry, were these. One morning the deceased had an

epileptic fit, and Risk Allah, a medical man, having attended to him, left him to sleep. At seven o'clock on that morning the chambermaid had gone into the deceased's room and had seen him asleep. At 7.30 Risk Allah came downstairs, went out, returning just before nine o'clock, when the landlord said that, as they had neither seen or heard anything of Readly since his fit, Risk Allah had better go and see how he was. The bedroom door was found fastened on the inside, and there was a strong smell of gunpowder smoke issuing from the keyhole. The door was broken open, and it was found on entering that furniture had been placed against it, and the room was full of smoke. A table and chair were found overturned. The deceased was lying on the bed, shot through the head. The right arm was across the stomach, and the left arm by his side. A recently discharged gun and a ramrod were on the floor by the side of the bed, and there was a chair close by, which had been overturned. Some shots were also found. On a table in the room was a piece of paper on which were written, in the handwriting of the deceased, the words "I have done it," the ink being still *wet*. The question was raised whether this was an act of murder or suicide. Risk Allah was discharged, and the act was pronounced to be one of suicide. Three years afterwards the whole case was gone into again in this country, on the occasion of an action for libel, in which the writer substantially charged Risk Allah with the murder of his companion, and a verdict, with heavy damages, was returned for the plaintiff.[1]

There was nothing in the *medical* circumstances of this case which justified a charge of murder.

In relying upon the relative position to the deceased of a discharged gun or pistol, an expert, unless he has had a large experience in such subjects, may be easily deceived, and draw a false conclusion.

A gentleman was out shooting with a double-barrelled gun. He had just put on the percussion-cap, and was holding the gun loosely in his hands, when the right barrel went off. From the recoil, with nothing behind the butt, the gun flew back a yard or two behind him, and the cap of the left barrel came so sharply in contact with the hard ground that it also exploded, sending the charge into the outside of the sportman's thigh. The shot passed through the right-hand pocket of his shooting-jacket, striking his shot-bag, and driving the brass top into the muscles behind the hip-joint. The metal head of the shot-bag deflected the charge, so that it passed round outside the thigh and lodged in the muscles. This deflection probably saved his life, as no great vessel was wounded.

Had the man been found dead in these circumstances, it might have been said that suicide and accident were impossible, that no man could have shot himself with a gun from behind in the manner described, and that the position of the gun, one or two yards behind the body, could only be explained on the supposition that someone had shot the deceased from behind.

In *R.* v. *Adams*, the prisoner was charged with the murder of his father; the wound which had caused death was situated at the back of the head. No weapon was found near; hence there could be no doubt that this was an act of murder. The prisoner was acquitted, since, although he was seen running from the spot at or about the time of the murder, another gun was heard to be discharged from the same spot about an hour afterwards; and it was impossible, from a medical examination of the wound to say at what particular time it had been caused.

There is, however, one position in which a weapon may be, which admits of very positive deductions, that is when the weapon is still *firmly* grasped in the hand of the dead man. This position proves most positively that, if the fatal bullet was fired by that weapon, the dead person fired the fatal shot himself (*vide* "Cadaveric Spasm"), but it does not of course prove whether he did it accidentally or intentionally; that must be left to other evidence to prove.

The absence of the weapon was of importance in the following case:--

The dead body of a young man was lying on its right side, with blood on the pillows and sheet near his head. There was a small entry wound behind his left ear, from which blood and brain substance had oozed, and a blunt wound an inch and a half long in his right forehead, which reached to the bone. No pistol or weapon of any kind was found near the body, but a pistol, cartridges, and an old hammer, stained with what appeared to be blood, were found concealed in a box in another room. At the *post-mortem* examination, on reflecting the scalp, a large amount of extravasated blood was found extending from the wound on the forehead to the occiput, and fractures extending through the frontal, temporal, parietal, and occipital bones. A flattened bullet, which had entered the skull by the wound behind the left ear, had left its track through the posterior lobe of the brain and the cerebellum, and was found an inch and a half above and behind the right ear, where it had fractured the bone, but was lying within it. The conclusions arrived at were—(a) that the bullet wound or the other injuries to the head were either of them sufficient to have caused death; (b) that the wounds could not have been self-inflicted; (c) that the bullet wound was the immediate cause of death. At the inquest a verdict of wilful murder against the deceased's brother was returned, but at the Old Bailey he was found to be insane.

Evidence from Direction of the Wound.

The course taken by a bullet when discharged at short distances, will indicate the direction from which the discharge took place, and thus aid in reconstruction of events.

Fig. 44. Murder by .32 pistol from behind. The lobe of the ear has been drawn to the left to expose the entry hole fully: the discharge clearly passed the lobe of the ear, the muzzle being held away from the skin.

In *R. v. Marris*, the deceased was shot while passing along a public path. If the prisoner were guilty, he must have fired the gun from a window more than 12 feet above the ground. According to the evidence, the shot must have been fired downwards. It had blown away the upper lip, the teeth, and the lower jaw. The prisoner was convicted.

In the following cases the direction in which the bullet struck deceased was a strong point in suggesting accident.

A well known amateur gunsmith aged 32 was found dead in his office at Baldock, Herts., lying on his back close to a telephone which was dangling as if he had tried to use it before collapsing. He had a ·22 in. bullet wound of the abdomen, 5ins. above the pubis, an inch to the left of the midline, scorched, but without muzzle pressure marks. The bullet had passed upwards at 30° to the vertical (if deceased were standing at the time of discharge), perforating the left common iliac artery and coming to rest between the neck of the 12th left rib and the spine. The wound appeared to be accidental. Shortly before his death he had left a friend to repair a weapon which was kept over his office. This weapon, freshly discharged, lay at the foot of the stairs leading from the first floor down to the office where he was found: it was thought he had been carrying it, stock down, by the barrel, going downstairs, when it happened to fall or the butt to strike a stair tread, going off owing to a very light pull: the trigger pull was only 1¼ lbs.

In January, 1904, an inquest was held by the East Cumberland coroner at Glassonby on the body of Mr. William Edwin Rowley. James Wilson, valet to deceased, said he left his master at half-past one on Thursday morning in the study. He had been drinking sherry, but was quite sober. At eight o'clock the same morning he found his master lying on the floor with a severe wound in his head. Deceased had not been in bed, and was still dressed in pyjamas and a coat. When witness went to bed a double-barrelled express rifle was in a cupboard. The gun had not been used by deceased previously, having just come from London. He did not know if it were loaded when he brought it into the house. He thought the gun had slipped and struck the fender, causing it to discharge. The bullet was explosive, and one of the kind deceased had used for killing big game in India. Dr. Winship said his opinion was that the explosion was quite accidental, for the expanding bullet struck the top part of the deceased's head, whereas if fired suicidally his face would have been shattered. The jury returned a verdict of accidental death.

Evidence from the Nature of the Projectile, Powder residue, Wad etc.

Useful evidence may sometimes be obtained by a careful examination of the projectile or any of the components of the discharge which may be found in the body, on the clothing or at the scene of the affair.

Laboratory examination[1] of tissues from the wound or from the margins of the hole in the clothes may be helpful in determining whether the injury has in fact been caused by a firearm projectile, and whether it is the entrance or exit hole of the projectile. Certain information as to the distance from which the shot was fired and the angle of incidence of fire may be obtained, as well as some indication of the nature of the propellant and of the projectile.

Stevenson[2] reported a case illustrating the disruptive effects of a high velocity bullet, in which the laboratory test of the remains proved the nature of the injury. The putrified remains were found on a farm. The skull was shattered but a reconstruction showed a hole in the right parietal region and laboratory examination gave a reaction for nitrates and nitrites on the surface of the bone. The inference was that a high velocity bullet had entered the head at this point and had shattered the skull. Evidence obtained later confirmed the conclusion that the dead man had been shot at close range with a Service rifle.

Photography by infra-red and ultra-violet light may show the presence of a smoke halo and its distribution, even when nothing can be observed by the naked eye.

X-ray examination may show fragments of the missile and fragments of bone lying along the course of the discharge. Microscopic examination

[1] Walker, J. T., 1911. *Police J.*, 14: 316 and 15: 66.
[2] Stevenson, R. V., 1951. *S. Afr. med. J.*, 25, 170.

may show traces of the powder used, fragments of the missile, damage to, or displacement, of fibres or evidence of burning or singeing.

Micro-chemical and spectrographical examination may show the nature and distribution of residues such as nitrites and nitrates from smokeless powders; sulphides, sulphites, thiosulphates, thiocyanates, nitrates or carbonates from black powder. The presence of traces of lead, associated with such hardening substances as arsenic, antimony or tin, and less commonly with traces of copper, bismuth, sulphur, may indicate that an ordinary lead bullet has been used. Bullets which have a hard jacket, such as automatic pistol and rifle bullets, and occasionally revolver bullets, may leave traces of nickel, copper or zinc.

The older primer caps may leave traces of mercury fulminate and potassium chlorate, the newer types usually contain lead azide and barium, while antimony and occasionally tin or nickel may be found in either. The finding of one or other of these substances by microscopic and spectrographic methods must be interpreted with caution, and other parts of the clothing must be examined for purposes of control. It is obvious, however, that a careful laboratory examination of materials is likely to be of considerable value in any particular case.

The pathologist should keep possession of any of the products of discharge which he may remove from a wound, until he delivers them into the hands of a responsible officer: everything should be handled with great care so as to avoid damage which might so easily deface evidence.

Shot-gun Wads. In shot-gun wounds, the examination of the wad or wads found in a wound or near a dead body has in the past led to the detection of the person who had committed a crime. In old-fashioned muzzle-loading weapons the wad often consists of a portion of cloth or paper which may be identifiable. Handwriting has been traced on the paper used as wadding, or it has been found to have been part of a printed page, of which the remainder has been discovered in possession of a suspected person. When a gun is discharged near to the body, a portion of the wad is often carried into the large irregular wound which is produced. This was part of the evidence in the case of *R. v. Blagg:*—

The peculiar nature of the wadding found in the body connected the prisoner with the act. In *R. v. Richardson,* the accused was convicted of murdering a policeman. Some paper wadding had been picked up on the spot where the deceased fell; and the gun which had one barrel loaded, and one empty from a recent discharge, was found in the prisoner's house within 24 hours of the murder. The wadding in the loaded barrel consisted of a fragment of *The Times* newspaper of March 27th 1854, and the charred and sulphurous pieces of wadding picked up on the spot were proved by the publisher of that journal, who gave evidence at the trial, to have formed a portion of the same impression. Though the explanation of the crime remained obscure, and the motive obscure, the evidence proved sufficient to convince the jury.

Such cases have now become historic since the introduction of machine-made cartridges and wads. Anything found in a firearm wound should nevertheless be preserved for evidence, for it may be necessary at a later date to compare such articles with articles seized in connection with the case. A wad, for example, may indicate whether a breech-loading or a muzzle-loading weapon was used, for in the former the wads are made from accurately cut circles of felt and cardboard. These will indicate the bore of the weapon, and may possibly give other information of value in identification.

Cartridge Cases.[1] If an automatic pistol was used, one or more cartridge cases will usually be found at the scene of the crime, and these are of more value than bullets for the identification of the weapon which fired them. When an automatic pistol is fired, the empty case is automatically thrown out of the chamber, and a new cartridge slides forward into its place. In this *automatic charging and ejection of the cartridge, several things happen which leave their imprint on the cartridge case.* The cartridge is forced up the magazine; its nose is directed towards the chamber by means of metallic guides; the breechblock strikes the base and forces it into the firing chamber. The firing-pin strikes the cap, and, on the explosion taking place, the breechblock moves backwards by gas pressure, the extractor hook catches the rim of the cartridge case, and it is pulled backwards with the sliding mechanism until it reaches *a bar of metal jutting from the side of the slide. The cartridge case strikes this bar on the side opposite to the extractor hook,* and as the hook continues its backward pull the case is thrown out. This occurs with a considerable amount of violence, and we may expect to find certain marks on the cartridge case from each operation, the extent of the marks depending on the violence of the operation. The empty case is therefore examined in detail first under a low-power microscope, later by the "comparator microscope" for any such marks.

On the surface there may be cuts or scratches caused by irregularities in the breech or in the slide; these may be absolutely characteristic and imprinted on every cartridge, as may marks of various kinds imprinted on the base and cap from the breechblock.

In *R. v. Boyce* (C.C.C., 1946) a cartridge case, ejected at the scene of the murder of a housekeeper by shooting through the head from behind, proved sufficient to force a conviction. Though the weapon was never found, a "test" shell case fired from it was available (in the possession of a friend of the suspect, from whom a pistol had been stolen). The firing pin marks, and the impressions stamped on the base of the case, showed areas of indisputable comparison, perfectly matched. Boyce was convicted.[2]

The mark of the extractor hook on the edge of the cartridge must also be looked for. This varies considerably in cases fired consecutively from the same weapon, in depth, length, etc., but if a number of cartridges are fired the characteristic marks will become obvious. The surface of the base must be examined for the mark of the ejector bar, which often leaves a most characteristic depression. Finally, the position of the depression in the cap, whether central or to one side, and the character and depth of the depression, must be noted.

When a weapon is seized, it has to be decided whether the empty cases were fired from that particular weapon. After the preliminary examination, already described, a number of rounds are fired from the weapon, using several different brands of ammunition, including, if possible several cartridges of the same make as the ones found. The weapon is fired into a long box of cotton-wool or rags (backed by a sandbag), the object being to obtain the bullets for comparison without distorting them, as well as the cartridge cases. The empty cases are collected and examined in detail, as outlined above, to observe whether the group of marks found on the seized case are reproduced on the fired cases.

[1] See also Sydney Smith and Glaister, J., 1938. *Recent Advances in Forensic Medicine.* J. & A. Churchill, Lond.; and Hatcher, J., 1945. *Firearms Investigation, Identification and Evidence,* Small Arms Technical Publishing Co., U.S.A.
[2] Simpson Keith, 1949. *Police J., 22, 32.*

The cartridges may be marked in such a characteristic manner that there can be no doubt of their identical origin, as in Fig. 45 (*R. v. Boyce*), in which there are scratches on the case of a particular kind, a definite extractor mark on the rim, and a firing-pin which strikes to one side. In other case the marks may be absolutely different, and at once reject the weapon. A great many
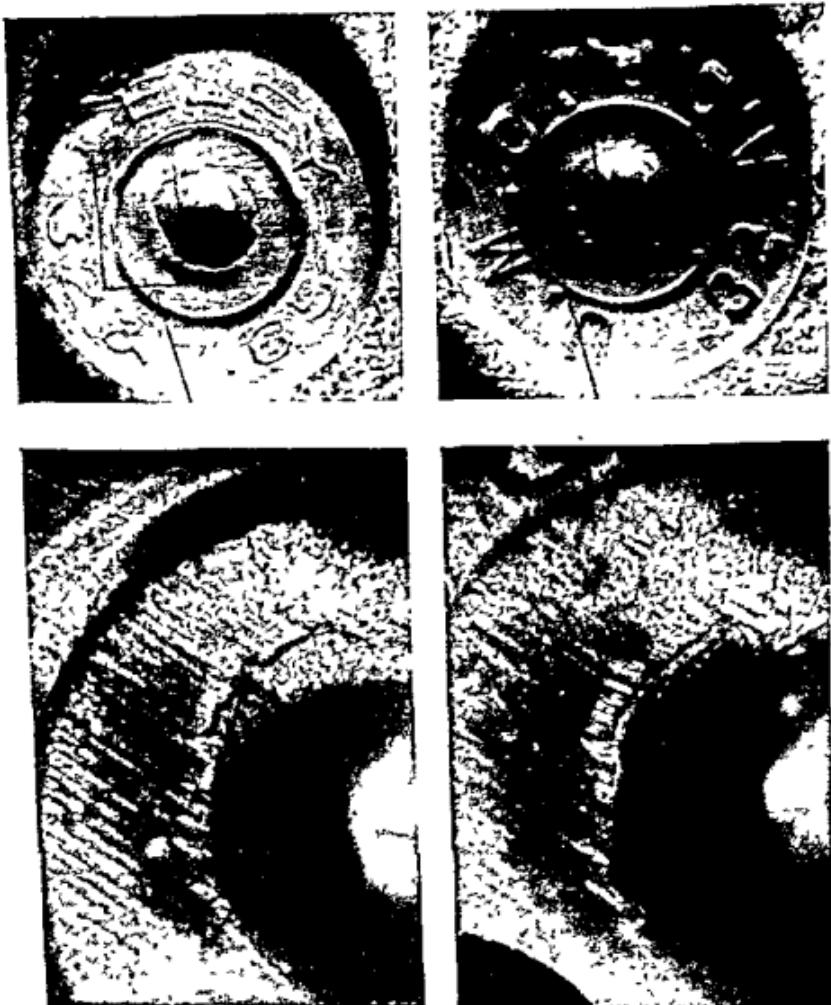
FIG. 45. Markings on base of (*R*) 32 U.M.C. and (*L*) Eley cartridge of same calibre, with higher power enlargements of two selected areas, showing innumerable fine impressions caused by breech face affording a basis for comparison between shell case found at scene of murder and one fired from suspect weapon. (*R. v. Boyce*, C.C.C., 1946).

cases occur, however, in which the marks are ill-defined, and the matter becomes more difficult. In many instances the marks on cases fired consecutively from the same pistol are too ill-defined for comparison; they are, however, in the same position on the cartridge, and this must always indicate the need to make further experiments and obtain new samples.

- It is never safe to say that a cartridge case was not fired from a given pistol unless the marks are entirely different, and a case which bears no well defined marks may quite well have been fired from the same pistol as one which leaves well-defined marks. In general, however, though it is unlikely that all marks will be equally good, it is usually possible to obtain definite information from the marks of the firing-pin, extractor, ejector, or breech-block on the base of the rim, or from grooves or scratches on the casing. In weapons of the same manufacture, the marks are of the same general nature, but in each weapon there are individual differences which usually enable it to be definitely identified.

Bullets. It is necessary to make a close comparison of bullets fired from the seized weapon with those found in connection with the crime. Half a dozen rounds are fired from the weapon before it is cleaned, marking each bullet and placing it in the same position in the firing chamber. It is then cleaned and a further series of rounds fired, using, if possible, similar makes of cartridges and others of different make. The bullets are then collected, labelled, and examined in detail. The weight, length, and diameter are ascertained. The projectile is then fixed in an instrument which enables one to examine its surface under a low power, and at the same time to turn it round—a comparator microscope will facilitate the examination of two bullets together for matching.

Every bullet fired from a weapon with a rifled barrel acquires certain marks. The most prominent of these consist of a series of grooves, sloping either to right or left, which are caused by the "lands" in the barrel of the weapon. The number and direction of these grooves are first noted; the pitch is then ascertained, and the width of each groove and space between the grooves. In between the grooves and at different parts of the surface of a fired bullet there are found marks and scratches of various kinds. Some of these are caused by slight faults or patches of rust in the barrel; others are caused by metallic fouling. The former are constant; the latter vary from shot to shot. Each individual groove and space between grooves is now minutely examined under the microscope for some individuality. It is obvious that in weapons of the same manufacture the number, direction, width, depth, and pitch of the grooves will be the same, but in every weapon certain individual differences are usually to be found in one or more grooves. There may also be definite characteristic marks between the grooves.

It should also be clearly understood that a slight difference in calibre of the bullet or a difference in the charge of powder may make a considerable difference in the markings. If the calibre is slightly reduced the smaller bullet passes through the barrel without definite grooves being cut into the surface, and even when bullets on measurement appear to be of the same diameter one will frequently be better marked than another.

a kind of glory, and that she was thereby enabled to identify the prisoner. This statement was confirmed by the deposition of the wounded person. Desgranges performed many experiments on this subject, and he concluded that on a dark night, and away from every source of light, the person who fired the gun might be identified within a moderate distance. If the flash were very strong, the smoke very dense, and the distance great, the person firing the piece could not be identified. The question was raised in the case of *R.* v. *White.*

A gentleman was shot at while driving home during a dark night; and he was wounded in the elbow. When he observed the flash of the gun, he saw that the piece was levelled towards him, and the light of the flash enabled him to recognize at once the features of the accused. In cross-examination he said he was quite sure he could see the prisoner, and that he was not mistaken as to his identity. The accused was skilfully defended, and he was acquitted.

Evidence of this kind has, however, been accepted in an English court of law. *R.* v. *Stapley* was a similar case.

The prisoner shot at a gamekeeper, on a dark evening in December, and the latter said that he distinctly saw the prisoner by the flash of the gun, and could identify him by the light of his features. This evidence was corroborated by three other witnesses who saw him not far from the spot, and by one who saw him in the act of running away. He was convicted.

In *R.* v. *Haines*, some police officers were shot at by a highwayman during a dark night. One of the officers distinctly saw, from the flash of the pistol, that the robber rode a dark brown horse of a remarkable shape in the head and shoulders; the horse had since been identified at a stable in London. By the same flash of light it was seen that the person had on a rough brown great-coat. This evidence was considered to be satisfactory.

There is no doubt that occasionally an assailant may be thus identified. It is to be noted, however, that there is comparatively little flash with nitropowder, and consequently little chance of identification of a person by the light produced by the discharge.

IMPUTED OR SELF-INFLICTED NON-FATAL FIREARM WOUNDS

Firearm wounds are sometimes voluntarily inflicted for the purpose of imputing murder or extorting charity. A man intending to commit suicide by firearms, and failing in the attempt, may also, from shame or a desire to conceal his act, attribute the wound to the hand of an assassin. In examining such imputed wounds they will be found to involve non-vital parts, except in cases of attempted suicide, and they will possess all the characters of near wounds. The skin around will be more or less lacerated and bruised; there will be much ecchymosis and there will probably be traces of blackening, scorching and impaction of powder particles in the skin.

discharged the weapon at about 80 cm. as he was climbing a wall to give chase. Examination of the shirt showed entry and exit wounds 36 cm. from the shoulder and 17 cm. to the left of the centre of the garment; the front hole, that of entry, was in the centre of a ring of scorching and blackening, and 9 cm. from it, and set on a slightly higher level, the laboratory experts found a faint area of blackening which was plainly that of a "blow off" from an ill-fitting revolver chamber. Chemical examination of the powder residue showed it to be similar to that of the guard's

FIG. 46a. Fabricated firearm wound, described in detail in text. (*Kayssi's Case* p. 402).
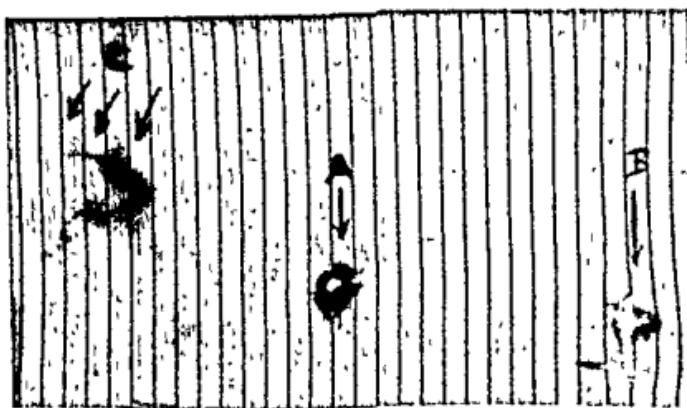
FIG. 46b. (*A*) Entry hole, (*B*) exit and (*C*) "blow-off" powder mark on shirt. (*Kayssi's Case*).

ammunition. There could be no doubt that the story the guard told was spurious. He had discharged the weapon through his own shirt, with the weapon in close contact, as shown by the "contact" entry markings and the blow off. The inside of the exit hole was also burned; both layers of the shirt had been held, as a fold of the cloth might be, against the muzzle at the time of discharge (see Figs. 46a & b).

The hand holding the weapon, as well as the dress, may be blackened or burnt. A firearm wound from an assassin may be produced from a distance, while an imputed wound which is produced by a person on himself must always have the characters of a near wound. If the propellant has been a nitro-powder, there may be little evidence of blackening or burning on the person or dress.

WHEN WAS THE FIREARM DISCHARGED?

Many attempts have been made by medical jurists to determine at what period a gun or pistol may have been discharged; but it is impossible to lay down any precise rules on the matter.

A chemical analysis of the products of decomposition in the gun-barrel, or of the particles of powder surrounding the wound in the body or the hole in the clothes, may give some information about the time at which the weapon was discharged and the nature of the powder used.

Black powder consists of an intimate mixture of charcoal, sulphur, and potassium or sodium nitrate (saltpetre). When this mixture explodes a considerable evolution of mixed gases takes place, the gases consisting of nitrogen, sulphuretted hydrogen, carbon dioxide, carbon monoxide and methane. This mixture of gases has a peculiar characteristic smell, which can be noticed for several hours after the discharge of a gun. In addition there is a formation of potassium sulphide and carbonate.

The sulphuretted hydrogen rapidly disappears, and the sulphides present become converted into thiosulphates, thiocyanates, and finally into sulphate of potassium.

We know that for a number of hours there is a smell of hydrogen sulphide, and, on chemical examination of the fouling, a reaction for sulphides will be obtained for five or six hours. Traces of thiocyanates and thiosulphates may be found at a very early stage, and these appear to increase for a few days. Sulphates are found only in traces for the first few days; they then gradually increase, and as they increase there is a tendency for the thiosulphates and thiocyanates to diminish. Iron salts in the ferrous state are usually found in traces in the early stages, and gradually become converted into ferric salts.[1]

The difficulty, however, in attempting to deduce the time of firing from the chemical examination of the products of decomposition lies in the fact that the examiner does not know and cannot know whether the barrel was clean when the shot was fired.

Nitro-powders or smokeless powders, which are in common use for sporting guns and in almost universal use for rifles and automatic pistol ammunition, are usually composed of nitro-cellulose or nitro-glycerine. These substances, on burning, leave traces of nitrates and nitrites which are not liable to undergo further changes by lapse of time. The solution obtained by washing out the barrel after firing smokeless powder is usually colourless, neutral, free from sulphides, and contains, as we have said, a quantity of nitrites and nitrates, which effectively distinguishes this type of powder from black powder.

The fouling of the barrel with smokeless powders is often dark in colour, but never has the black appearance seen after ordinary gunpowder.

For further reading on the technical aspects of firearm wounds investigations, the reader is referred to:

Walker, J. T., 1916. *J. Crim. Law and Criminol.*, 31, 497.

[1] Walker, J. T., 1941. *Police J.*, 14, 316 and 15, 66

INJURIES FROM DETONATION OF HIGH EXPLOSIVES

The effects of an explosion upon persons near enough to suffer more than the "ear-splitting" bang due to sudden displacement of air consist of:—

1. Blast wave injury—a peak of intense pressure being followed by a trough of low pressure and a return to normal.

2. Scorching by flame or hot gases.

3. Direct injury by flying missiles.

4. Anoxia due to the consumption of oxygen, and poisoning by inhalation of CO, nitrous and nitric gases, H_2S, SO_2 and HCN.[1]

Those who are unfortunate enough to become buried under debris and pinned for a long period of time may suffer the sequence of events, upon release, which is collectively described as the crush syndrome (see p. 332) in addition; but we are concerned here with the effects of blast.

Such is the intensity of pressure built up by the detonation of high explosive within a shell or a bomb at the moment of bursting that its sudden release is likely to disintegrate anything in the immediate vicinity: anybody near enough will be almost completely disintegrated, and study will be limited to identification of remains—and of foreign metallic and other matter, embedded in the fragmentary tissues, from which some clue as to the source of the explosion might come.

In 1940 a violent explosion shook the town of Waltham Cross, and a pall of smoke was seen rising from the small arms ammunition factory that lay on its outskirts. Three men had disappeared, and, though some 339 fragments of human skeletal and other tissues were found in the vicinity, it was not possible to say more than:—

(a) They were human remains, freshly disintegrated by some high explosive force.

(b) They represented only a small part of three persons; but no part of a fourth was found. (It was important to rule out the presence of unauthorized persons, as a strict espionage check was in force).

(c) The cause of death might reasonably be said to be disintegration by explosion—though so extensive was the disruption of tissues that no one could have attempted to say whether the victims were alive or dead at the time.

(d) No evidence of prior foul play arose from the examination of the remains.

The local atmospheric pressure may, according to Sutherland,[2] be raised to something in the neighbourhood of 3,000 lb. per sq. in. by this blast wave, but its power falls away rapidly. At 15 ft. from a 125 lb. bomb explosion the pressure has fallen to 200 lb. per sq. in., and at 50 ft. it barely exceeds 10 lbs. above normal atmospheric pressure.

During the second world war it became apparent even to the man in the street that the effect of an explosion was curiously uneven in its distribution: a capricious disintegration of one window and the escape of an adjacent pane might equally be reflected in blast "picking off" people in a group placed more or less equally near the source of the explosion.

Barrow and Rhoads[3] describe the case of a man who was standing between two other men fatally injured by an explosion, one of whom was found 42 ft. away, and yet who sustained only a perforated tympanic membrane. In another case described

[1] Dutra, F. R., 1949. *Amer. J. clin. Path.*, 19, 599.
[2] Sutherland, G. A., 1940. *Lancet*, 2, 641.
[3] Barrow, D. W., and Rhoads, H. T., 1944. *J. Amer. med. Ass.*, 125, 900.

by the same authors a soldier who was resting his chin on the shoulder of another who was "blown to bits" received only a fracture of the maxilla.

When waves of pressure are deflected or meet, some intensification of damage may ensue, and the distorting or compression-and-release effect of these waves of pressure may stretch and tear the tissues, compress, then distend and burst them, or drag them from their attachments. Those parts which are most fragile, most easily displaced or distorted—the lungs, abdominal viscera and brain— are the parts most likely to show "blast" lesions. We must consider the appearances of some of these, for they are easily overlooked and death may be attributed erroneously to some other cause or raise suspicion of foul play if they are not recognized.

Blast Lesions. The most common lesion in blast injury, apart from major tearing of tissues by displacement from their moorings, is the rapid development of scattered foci of small hæmorrhages, mostly in organs easily changed in shape and supplied with a fairly rich network of vessels, like the brain, the lungs and the mesenteries of the bowel—or the bowel itself. These are the result of direct compression/decompression strain which, like the shear strain causing brain injury, stretches and tears the tethering of tissues—and vessels, or disintegrates their capillary network. Violent compression/decompression, followed by stasis and anoxia is also responsible for the development of the passive hyperæmia which, complicated by attendant œdema, causes serious secondary brain and lung lesions: the changes in the lung may be mistaken for a rapidly developed pneumonic consolidation, but microscopy will distinguish the lesion as a traumatic one with interstitial and intra-alveolar haemorrhages in large numbers.

Intracranial hæmorrhage, contusion of the brain, aortic and heart injuries, pneumothorax, ruptured stomach and bowel, even bladder injuries have also been described.[1]

[1] Moritz, A. R., 1954. The Pathology of Trauma. London, Henry Kimpton.

CHAPTER XII

DEATH FROM LIGHTNING AND ELECTRIC CURRENTS

DEATH by lightning is sufficiently common to require both the doctor and pathologist to understand the phenomena which accompany it; but there is a more important reason why he should devote some attention to this subject, viz., that the appearances left on the human body sometimes closely resemble those produced by great mechanical violence. Whenever a discharge of enormous potential takes place close to a person, injury may ensue from

- (a) The direct effect of the current passing through—or over the surface of—the body.
- (b) Flash burning or patterned scorching.
- (c) The expanded, displaced—and returning air, causing disruptive or blast-like lesions.

Thus a person may be found dead in an open field, or in the highway; his body may present marks of contusion, laceration or fracture; and to one unacquainted with the fact that such violence occasionally results from lightning, it might appear that the deceased had been maltreated, possibly murdered.

Deaths from lightning average ten every year irrespective of the number and severity of thunderstorms;[1] deaths from electric currents vary from year to year, but on the whole, steadily increase owing to the enormous growth in the production of electricity for industrial purposes.

The Registrar-General for England and Wales reported five deaths from lightning for the year 1951 (three males and two females). In the same year there were 102 accidental deaths from electric currents (85 males and 17 females).

In the usual type of accidental contact with "live" wire or apparatus, an electric current of some hundreds or thousands of volts passes through the body, and may continue to do for an appreciable length of time. The amount of current flowing through the body may be given as $\frac{CV}{R}$—where C=current in amperes, R=resistance of body in ohms, and V=volts pressure. In general, it is true to say that the higher the voltage the greater the likelihood or even certainty of fatal effects, but many apparently paradoxical cases are recorded. Currents of voltage as low as 100, or even 65, have caused death, and those of 500–5,000 volts are usually fatal. On the other hand, a considerable number of cases have survived contact with 10,000 volts. In most of these cases there were circumstances present which caused an increased skin resistance, so reducing the effective amperage, and modifying the electrical effects, but the complete explanation is probably to be found in the route taken by the current in its passage through, or close to the body and the high resistance of the skin and other surface tissues. It is generally considered that alternating current is more dangerous than direct or continuous, but, while there is

[1] *Brit. Med. J.*, 1951, **1**, 1400 (vital statistics).

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some experimental evidence to support this opinion, it is by no means conclusive. For judicial electrocution in the United States, electrodes are attached to head and leg, and alternating currents of 2,300 and 550 volts,
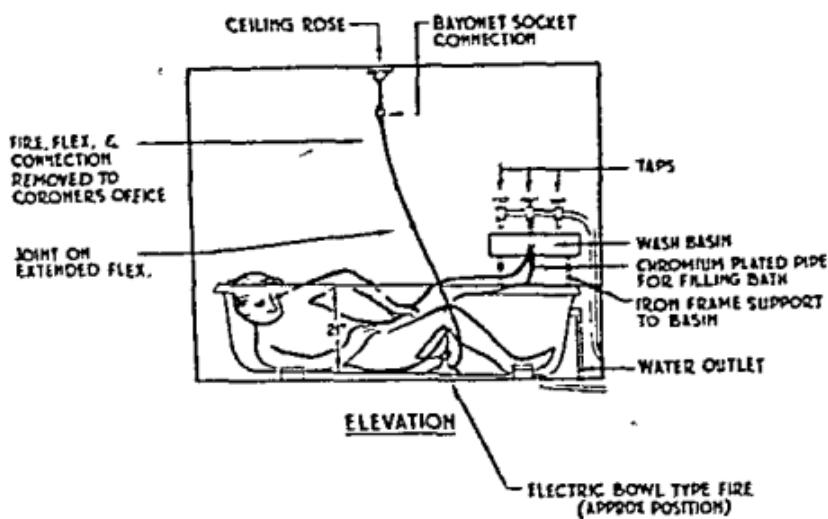
FIG. 47. A helpful plan of a scene of electrocution in a bath, showing the source of the current (through a jointed flex leading to an electric fire lying against the R thigh) and the earth connection (through the L foot making contact with a bath pipe). Water had been in the bath, but had drained owing to a faulty plug.

at about 7¼ amperes, are applied in succession for about 7 and 52 seconds respectively, each being repeated once.[1] For the convulsion therapy applied in certain serious mental disorders, 80–100 volts are commonly employed, the current being passed for about one-fifth of a second, with the electrodes applied to the temporal regions of the head.

A flash of lightning is due to the passage from a thunder cloud to the earth of a direct electric current of enormous potential, amounting to something like 1,000 millions of volts at about 20,000 amperes. Along the track of the current, much energy is liberated, most of which is converted into heat. The diameter of the track is variable, but considerable, and the course pursued is erratic and not necessarily in the path of least resistance. Branching flashes are given off, particularly in the lower part of its passage, and the effects may therefore be distributed over a surface area of 100 ft. diameter or more.[2] Though lightning and more ordinary electric currents may therefore be considered as differing only in degree, it is not surprising, in view of the enormous energy involved, that bizarre disruptive effects occur more frequently in lightning accidents.

A woman of 43, sitting with about a dozen other people in a tin-roofed shelter in a public park in London, had a child five years of age on her left knee. The group was struck by a violent discharge of lightning which threw them in various directions, killing seven. The woman who bore the brunt of the discharge had her clothing violently ripped apart over the right shoulder and chest, the brassiere was split and the steel strips of a corset, partly melted, stripped out and thrown some feet away.

[1] Hassin, G. B., *Arch. Neurol. Psychiat.*, 1933, 30, 1046
[2] Jex-Blake, A. J. *E. Afr. med. J.*, 1945, 22, 170.

An extensive flash burn extended across the right jaw line on to the neck, widening over the chest front, following a corset steel line to the groin (marking a suspender buckle area on the right thigh front) and leaving the body at the right knee. The child sitting on her left knee escaped, dazed, crying, but recovering before arrival some 15 or 20 minutes later at hospital. Autopsy on the electrocuted woman was not authorized.

Skan[1] reported the case of an African lying on a mat with his head on a folded fez cap, killed as he lay by a lightning discharge which ripped away the left shoulder prominence and tore a large hole in the left side of the neck. The right side of the abdomen was slate grey, the skin dry and parchment-like. No burning or singeing had occurred. The left frontal bone, right parietal bone, skull base and left humerus were fractured, the latter avulsed into the left shoulder wound together with torn muscle. The position of the body had remained unchanged. The sleeping mat was "blown to pieces", parts being found clinging to the roof of the hut. A brother sleeping in the same hut on a bed escaped "somewhat dazed" only.

The intense heat engendered by the flash may fuse metallic objects on the victim, or in the immediate neighbourhood. For the same reason, severe burns may be found. There may be evidence of severe disruptive effects on the tissues or on the clothing. Indeed, the clothing is frequently torn into shreds, and may be thrown to some distance from the body. Metals may be fused, burned away or rendered magnetic.

Signs and Symptoms of Shock by Lightning or Electricity

(a) **General Signs and Symptoms** can, in many cases, hardly be said to exist, death being practically instantaneous; but in those who recover, many symptoms are described as occurring at the time and immediately afterwards. As a rule, there is no sense of pain, the person being thrown at once into a state of unconsciousness which may last for a few minutes or several hours, rarely for days; and very rarely he may be found in a state of suspended animation requiring prolonged artificial respiration. Urination and ejaculation of semen are fairly common.

In a fairly typical case which did not prove fatal, the victim, who was seen soon after the accident, displayed the following signs:—insensibility; deep, slow and interrupted respirations; entire relaxation of the muscular system; the pulse soft and slow; the pupils dilated, but sensitive to light.

A state of restlessness, irritability and excitement may ensue, with tremors and twitchings or severe convulsions. The following description of a case by Taylor illustrates this latter point, and is of interest in view of the present use of shock therapy:—

An hour and a half after a lightning stroke, a healthy man lay completely unconscious, as if in a fit of apoplexy; his pulse was below 60, full and hard; his respiration snoring; his pupils dilated and insensitive. There were frequent twitchings of the arms and hands, the thumbs were fixed and immovable, and the jaws firmly clenched. Severe spasms then came on, so that four men could scarcely hold the patient in bed, and his body was drawn to the left side. When these symptoms had abated, he was copiously bled; cold was applied to the head, a blister to the nape of the neck, and mustard poultices to the legs. Stimulating injections and opium were also administered. In the course of 24 hours, consciousness slowly returned, and the man soon recovered completely. The only external injury discoverable was a red streak, as broad as a finger, which extended from the left temple over the neck and chest; this disappeared completely in a few days.

On recovering consciousness, there is usually a retrograde amnesia, which may be complete, or the victim may only remember a flash of light, the feeling of a blow, or some similar sensation. Headache and dizziness, noises

[1] Skan, D. A., 1949. *Brit. med. J.*, **1**, 666.

in the ears, and visual disturbances may be complained of. Pupillary anomalies may be detected on examination, and there may be cyanosis and œdema of the limbs. Localized anæsthesia or paræsthesia may be experienced, or motor effects ranging from mild paresis to complete paralysis of one or more limbs. Severe results of this nature, and others such as blindness, deafness and loss of speech, are fairly common after lightning stroke, but usually clear up within hours or days, and are to be distinguished from the more persistent sequelæ discussed later.

The following description is of a case, incorporated by Taylor into an earlier edition of this work, which illustrates a number of these signs and symptoms very well:—

A man was struck by lightning. Externally there was a burn upon the nape of the neck, where a metallic watch-guard rested; and from the point where the current of electricity left the chain, the skin was blistered in a straight line down to the feet, and the hair of the pubes was scorched in its course. His intellect was confused, and his general condition was that of collapse. With the aid of stimulants, he became sufficiently restored to describe his feelings. There was paralysis of the lower extremities, with loss of sensibility (anæsthesia), and retention of urine. He was deaf, and complained of a noise in his ears like thunder; he had some difficulty in articulating, pain in swallowing and a peculiar metallic taste in his mouth. The anæsthesia passed away in half an hour, but he did not completely recover the use of his limbs for four days; the bladder was paralysed for 24 hours. The bowels were confined. All these symptoms gradually disappeared, excepting slight deafness; and he was discharged convalescent.

The local effects of currents are seen chiefly in the form of burns at the sites of entrance and exit of the current, and occasionally at the flexures of the bent limbs where it has jumped across. Whenever there has been sparking, electric burns or splits in the skin may be found. These are characterized by dryness or charring, insensitiveness, and local capillary contraction with coagulative necrosis. Shedding of the superficial layers of the skin is common, and some of this may be found attached to the conductor.

Wrinkling of the skin may also be found, and occasionally localized œdema of a limb. After a variable latent stage, aseptic necrosis is apt to develop without any general manifestations. This necrosis often extends beyond the burn in area and depth, and may lead to spontaneous amputation. Healing is as indolent as with all burns.

In addition to the burns, there may be at the site of entrance and exit of the current, a number of greyish-white circular spots, which are firm to the touch, and are free from the zone of inflammation found in burns. Skin and other tissues may be split and torn, and bones may be fractured.

Henderson, D. K., and others,[1] in a series of 260 patients treated by convulsion therapy, encountered four instances of compression fracture of vertebræ, one case of fractured femur and several cases of dislocation of the jaw. Small ecchymoses or large bruises may be found.

In a certain number of cases of lightning stroke, peculiar aborescent markings are found on the skin, which have been likened in appearance to the morning frost on a pane of glass. These are not burns, but are said to be due to minute depositions of copper in the dermis.[2]

Metzdorff[3] describes a case of epilepsy occurring in a woman who was struck by lightning during a thunderstorm. She was unconscious for 10 minutes and recovered

[1] Henderson, D. K., *et al.*, 1943. *Endin med J.*, 50, 641.
[2] Critchley, M., 1935. *Lancet*, 2, 1002
[3] Metzdorff, P., 1937. *Klin. med. Wschr.*, 2, 1255.

without any sign of paralysis or of burning. Eight days later, epileptic attacks commenced.

Cataract, deafness, vasomotor instability and various hysterical manifestations have also been described.[1]

Treatment of Persons who have been Struck by Lightning or Shocked by Electricity

Most of the cases when seen will be either dead or require no treatment beyond artificial respiration and bodily and mental rest. Great care should be exercised in removing the victim from any live wire, otherwise a multiple tragedy may result.

Jellinek[2] considers that electric shocks cause only *apparent death* in the majority of cases, and advises that artificial respiration should be carried on for hours, and oxygen administered in every instance. He quotes the case of a workman at St. Denis, who was overwhelmed by a current of 4,500 volts and 75 milliamperes, which passed through his body for several minutes. He was apparently dead, but under artificial respiration he revived in two hours, and completely recovered except for certain burns.

The essentials in treatment of electric shock are—firstly, to extricate the victim from the current, and secondly, to treat the apparent death instantly and continuously by artificial respiration. Inhalation of oxygen mixed with 5 per cent carbon dioxide is of value in many cases, and cardiac and respiratory stimulants may be required.

In regard to prophylaxis, certain elementary precautions should be memorized; (1) Never to touch any part of an electric lighting or heating apparatus with wet hands; (2) never to handle any part of an electric lighting or heating apparatus while touching water taps or pipes, or any other metal which will make a good contact with earth; (3) to fix electric fittings as far as possible away from water fittings, to use "string-pull" switches wherever danger might exist, and to earth any apparatus.

Sequelæ

As distinct from the many transient disabilities which may follow immediately upon shock from electric current or lightning, a variety of more persistent sequelæ have been described. Headaches and giddiness may recur over a long period. Insomnia and defective memory are not uncommon. Irritability and inability to concentrate are, perhaps, the most frequent of subtle changes in personality which may be noted, and which occasionally develop into a true psychosis. Hysterical phenomena may persist over a long period. Permanent damage to the central nervous system may be manifested by increasing spasticity and weakness in the limbs, or progressive wasting of certain muscle groups, conditions clinically resembling disseminated sclerosis and progressive muscular atrophy respectively. Cerebral damage may result in hemiplegia, aphasia, deafness or epilepsy, and a slowly progressive cerebellar syndrome has been recorded.

Post-Mortem Appearances from Lightning or Electricity

Externally. Much of the autopsy features of electrocution must depend upon the variety of injury sustained, on the potential and amperage of the

[1] *Lancet*, 1910, Leading article, 1, 351.
[2] Jellinek, S., 1925. Der Elektrische Unfall. Leipzig: Deuticke.

discharge. the resistance offered by the skin, and the circumstances of electrocution.

When blast is responsible for death, minute petechiæ similar to those seen in explosive blast injury (p. 406) may be found in the scalp, brain, lungs and more mobile and vascular tissues of the abdomen. When the current has flashed, electric burns will be a feature, and, if the discharge is violent, splits in the skin, disruption of the tissues and fractures are common. If, on the other hand, a relatively low potential current has entered (and left) the body easily—as through a damp skin or wet footwear—little or nothing may be found.

A boy of 13, returning from a cricket match in Epping Forest in 1946, was walking across a common followed by another lad of the same age when both were thrown to the ground by a flash of lightning and a violent crack of thunder. The boy in the rear recovered himself "after a few minutes" ran for help and secured an ambulance which conveyed the leading boy to hospital: he was found to be dead. A police officer found a freshly burnt patch of dry grass some 2 to 3 feet from where the boy had been struck. Autopsy showed classical blast petechiæ in the brain, lungs and upperabdominal mesenteries, but there were no burns or other marks on the body.

A man of 57, subject to brainstorms for 30 years, was seen to be acting peculiarly on the evening of a day in August 1953. He left home, and was next seen, some 20 minutes later, wandering along an electrified rail track in South London. A driver "saw him go towards the line, put out both hands and grasp the conductor rail". He managed to stop 2 feet short of the body—by this time "burning". The deceased man was hooked off and resuscitation applied without avail. Autopsy showed destructive charred and wrinkled burning of the grasping surfaces of both hands—and over the front of the right ankle (presumably by an earthing contact).

A girl of 16 was found dead in her bath as a result of search being made to identify the source of a "blown" fuse. A table lamp which had been perched on a bathroom shelf had fallen into the bath. She bore no marks of any kind on the surface of the body, and autopsy revealed only some congestion and cyanosis in the cavities of the heart and the lung beds.

The pupils are usually widely dilated immediately after death. *Rigor mortis* probably varies with the nature and direction of the currents, i.e., whether the core or side currents pass through a muscle or many muscles disrupting it or them, for in many cases it has been observed to occur as usual.

Generally speaking, there are external marks of electric burning, contusion or laceration about the spot where the electricity has entered or passed out; sometimes a severe lacerated wound is found together with rough fractures of the bones. There may be, on the contrary, no wound as such, but an extensive ecchymosis, which, according to Jex-Blake,[1] is most commonly seen on the skin of the trunk. On the head, a rounded effusion may be present in the scalp, simulating the results of a blunt injury. In several instances there have been no marks of external violence, and it frequently happens that they are so slight as to require careful search. The *wounds* have commonly been *lacerated* punctures, like *stabs* from a blunt dagger. Fractures of the bones have not been commonly observed, but they do occur, especially in accidents from lightning as opposed to industrial electricity. The burns, if produced by the current, are usually deep, but limited in area, but they are commonly produced by the smouldering clothes or by fused metallic substances which have been on the person when struck by lightning. The greyish spots or arborescent markings, formerly described, may be found on the body after death.

On the other hand, it occasionally happens both in death from lightning and from electric currents, that nothing can be found either externally or

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[1] Jex-Blake, A. J., 1946. *Lancet*, 1, 351.

internally to indicate the cause of death. We have seen cases of death from both lightning and domestic electrocution in which no lesions were found. Death in these cases is due to a functional stoppage of circulation and respiration, possibly by vagal stimulation, possibly medullary: there is absolutely nothing at autopsy by which one can say precisely what has operated to cause death except the circumstances.

A man of 21, working an electric drill into solid concrete wall on the second floor of a block of business offices in the course of erection at London Bridge Station suddenly gave a cry, fell backwards, clutching the drill, and, after a few convulsive movements, lay still; he was dead. Autopsy revealed no marks of injury, nor any flushing or singeing of the skin. No pathological changes were found, and microscopy was unrewarding. Examination of the drill showed a defective wiring which had frayed and permitted a "short" to the drill casing. Deceased was sweating at his work and his socks and boots were, like the floor on which he stood, very damp.

A metal worker of 16 was found unconcious lying on a conduit at his place of employment. He had walked to the rear of the premises to a dynamo house in which a conduit ran round a galvanised tank, and had evidently urinated on to a live conduit. His trouser buttons were undone. The current was shut off immediately but efforts to revive him were of no avail. Three scattered burns lay on the left arm, one above the elbow and two at the wrist. It was presumed he had received a shock through the stream of urine and, convulsed by this, had lost his balance, falling on to the conduit; he knew well enough that it was dangerous to touch.

Internal Appearances. Remarkably little change may be found except where some gross surface lesion has already been located. The changes of blast have already been described and there remain but a small number of "features of electrocution" which, in fact, have no specificity whatsoever: they are the result of circulatory stasis and anoxia, consisting of generalized congestion and cyanosis, some dilatation of the heart, and petechial hæmorrhages under the endocardium, pericardium, pleural and other membranes. The blood has the normal power of coagulation and defibrination.

Histological investigation has revealed hæmorrhages throughout the brain, but especially in the medulla, patchy chromatolysis of nerve cells, and dilatation of the perivascular spaces, especially in the brain stem and the cervical part of the cord.[1] In the peripheral nerves, fragmentation of the axons, ballooning and disintegration of the myelin sheaths, and infiltration with endothelial cells have been noted. After very severe injury, considerable areas of the brain and cord may be found swollen and softened. Such changes are by no means constant or characteristic, however, nor can they be considered as peculiar to shock by electricity. Indeed, even where electric current or lightning is known to have played a dominant role in the causation of death, it is difficult or impossible to separate those findings which are due to the electricity from those caused by physical violence, or more frank blast.

In cases of death from shock therapy, small hæmorrhages and damage to minute cerebral vessels have been found, with some alterations in brain cells. These changes are not sufficient in themselves to explain death, and no doubt the physical changes which accompany convulsions in most cases and death in a few, are mainly due to the development of anoxia: they are similar to those seen in status epilepticus.

Cause of Death from Electricity or Lightning

The actual effects of the passage of electric currents through the body are still incompletely understood, notwithstanding the numerous investigations

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[1] Critchley, M., 1934. *Lancet,* **1**, 68.

into the cause of death by accidental contacts, judicial electrocution, and as a result of convulsive therapy.

In many cases, of course, the cause of death is obvious enough in the shape of some gross destructive lesion, or the tearing of a large vessel. But very often, in those killed instantaneously, and even in those who survive for a variable time and then die, no such gross injury can be found to account for death. The elimination of blast injury, seen only in lightning deaths, leaves a number of cases in which nothing is found apart from the signs of acute anoxia.

It is probable that electrical currents cause death in at least two distinct ways. When the potential is not very great, and the current traverses the body, there appears to be a direct action of the heart muscle or innervation, causing fibrillation for a short period, followed by stoppage.[1] It has been suggested that increasing the current in such cases may cause the heart to resume its action, and indeed such a procedure has been used to resuscitate those whose circulation has ceased during anæsthetic or operative procedures though with little success.

With currents of high potential or of great magnitude, death is due to inhibition of the respiratory centre in the brain, and breathing ceases while the heart continues to beat.

The human body would be a good conductor of electricity, owing to its fluid and salt content, if it were not for the insulation afforded by the skin. But the resistance of the skin varies with its thickness and its dryness. A man bathed in moisture should form a much better conductor than one with a dry skin, and this theoretical point is borne out by the observation that the number of accidents varies directly with the meteorological conditions. Unfortunately, it is often stated that currents of 100 to 150 volts are harmless, while those of 200 and over are dangerous. This is incorrect, for deaths from currents of 50 volts, when acting under conditions of dampness, occur by no means infrequently. The amount of current flowing through or over the body is a function of $\frac{CV}{R}$ where C=current in amperes, V=strength or tension of the current in volts and R=resistance of the skin in ohms. Currents of low tension (200 volts or less) commonly cause cardiac arrest with fibrillary contractions.

At a Paris conference in 1921, two cases were quoted in which the victims while in a bath, touched in one case, an electric radiator with faulty insulation, in the other, a metal bell-pull into which there was a leakage of current. In a third case, a workman was electrocuted by a current of 155 volts from a hand-lamp while working in a boiler. In Switzerland during 1919, six deaths occurred from contact with ordinary hand-lamps, and during the war period 1914-1918, 11 fatal cases were reported in the German literature from the therapeutic application of a sinusoidal alternating current of 50 volts and under.

Besides the strength, frequency and nature of the current, and the resistance opposed to it, the danger of any particular current is influenced by the following factors: (a) the site of entrance into the body (b) the part traversed by the current (c) the duration of the contact (d) the size of the area under contact (e) the physical condition of the individual, and (f) the psychic component. Expectation of a current diminishes its effect, while surprise increases it. An example of this factor is afforded by an engine-driver, who made a habit of catching hold of a 50-volt lamp with both hands, and letting it go again, as a bet for a glass of beer. He repeated this as often as the beer

[1] Urquhart, R. W. L., 1927. *J. industr. Hyg.*, **9**, 140.

was forthcoming, until one day he *accidentally* came into contact with the lamp under the same conditions, and collapsed dead on the floor.

Dampness of the floor (and often of the footwear) permitting easy earthing is a common circumstance in electrocution. We saw five separate cases of electrocution by domestic 220-240 volt alternating current during the Second World War among those fitting out bomb-proof cellars or shelters with electric light: many were flooded, all damp. One man was "standing in water with his boots soaked, using pliers on a light circuit"; another was changing lamps over wet duck-boarding.

The public supply of electricity in Great Britain has been developed by a system of overhead conductors carrying currents at a pressure of 132,000 volts. From these mains, the current is tapped and transformed into lower voltages as required by different localities. The presence of these pylons throughout the country has already led to many deaths, some by accident, and some apparently by design.

An extraordinary case occurred at Preston in 1933, in which a boy survived after making contact with one of the conductors. He climbed a pylon, and when on a platform 200 feet from the ground, a sheet of flame was noticed, and the youth was knocked over. His clothing was burnt off, and his skin badly burnt, but nevertheless, he was able to climb to the ground without assistance. He was taken into hospital and appeared to be making a good recovery from the shock, but toxaemia and pneumonia supervened from which the youth died about a fortnight after the accident.

It cannot be conceived that a current of 132,000 volts could have passed through his body without causing death. Such accidents as these commonly result in extensive flash-burning, the current discharging *past* rather than *through* the body.

Jellinek has pointed out that the susceptibility to electrical currents varies considerably in different animals; also that, in human beings, those in bad health (especially with heart disease and nephritis), are more affected than those in good health. He has also shown that during anaesthesia and during sleep, the body is much less susceptible than it is when the person or animal is conscious. States of anxiety increase the danger.

The following cases are illustrative of the effects of lightning:—

A farmer, aged 54, had apparently been struck dead by lightning about half an hour before he was examined. He was found about 30 yards from the house lying dead at full length, with his face downwards, his right hand in his trousers pocket; a small pool of blood was under his head. Both cloth leggings were torn almost from top to bottom, and a small piece of one was lying near. In the left parietal scalp there lay a wound the size of a penny; the soft structures were disorganized down to the bone, but the bone appeared uninjured. The hair round the wound was singed and a red line of hyperæmia about a quarter of an inch broad could be distinctly seen running in an oblique direction down the neck and over the middle of the clavicle to the epigastrium. The hair of the neck and body was burnt and singed along this line, and there was a strong smell of burning when the clothes were removed. At the epigastrium this line merged into a diffused hyperæmia, which involved the whole of the lower half of the trunk and both the thighs. The hyperæmia ended at the knees, but a red line similar to that above described ran down the outer side of the right leg and foot to the little toe. The inner surface of the right foot was torn along a line corresponding to this. On the under-surface of the left foot, just below the instep, was a fresh bleeding wound the size and shape of a threepenny piece. There were two bulbæ about the size of a man's thumb in the left groin. There was no watch or any other article whatever found in the pockets. There was an iron wire round the brim of the hat, apparently used for stiffening purposes; the hat itself was torn to pieces, leaving this exposed. It was found about a yard away from the body.

A non-commissioned officer was sleeping with three other men in a tent, when suddenly a lightning discharge killed his companions. The man experienced what he described as a "throbbing burning" pain in his right elbow and "pin and needle" sensations extending "down the thigh and leg of the same side, lasting a few minutes." For half an hour he lost the use of his arm and leg, but consciousness never left him. The wounds were dressed, and he was taken to Middleburg Hospital. On examination some two to three weeks later an extensive granulating ulcer was found on the outer surface of the right elbow, and on the outer surface of the right thigh there lay concentric pouched-out-looking scars, five on the outer surface of the leg, one over the external malleolus, and one over the ball of the little toe. They varied in size from a half-crown to a threepenny-bit. The scars corresponded to circular "pin head" perforations in the riding breeches and socks. There was a mere trace of charring at the periphery of the punctures. There was neither anæsthesia nor atrophy of the muscles. The knee-jerk reflex was absent on the affected side, but the other reflexes were normal. There was no reaction of degeneration. Pressure over the brachial plexus and over the great nerves in the upper part of the arm elicited a feeling of "electric shocks" and visible tremors of the whole limb. There was no result on applying similar tests to his leg. Four times a day for the previous fortnight at regular intervals the patient had an attack of "tremors" in his right arm and leg, which lasted for fully five minutes. He complained of no pain during these attacks, but said that he had a feeling of loss of power. The attacks suddenly ceased. There had been no trouble throughout with the bladder or rectum. He made a complete recovery.

Mackintosh was called to see three persons who had been struck by lightning about *twenty minutes* previously. They had taken shelter under a haystack, which had been set on fire by the same flash.

(1) A boy, aged 10, was by then able to walk, although unable to move his legs immediately after the occurrence. All that he remembered was that he saw the stack on fire, and called to his father; he felt "dizzy all over," and unable to move. His hair and clothes were not singed, and the metallic buttons on his dress showed no fusion. On removing his clothes, a slight odour of singeing was perceptible. He complained of pain at the lower part of the abdomen. There were several red streaks, of about a finger's breadth, running obliquely downwards and inwards on either side of the chest to the middle line in front of the abdomen; they then descended over the pubes, and were lost in the perineum. This boy recovered; the red streaks gradually disappeared, and could hardly be traced four days after the injury. (2) Another boy, aged 11, lay prostrate and unconscious, with an expression of terror and suffering; he frothed at the mouth, moaned piteously, and flung his legs and arms about in all directions. The respiration was deep, slow, and laborious, the heart palpitating, the pulse weak and very irregular; the pupils were dilated and insensible to light. There were, in this case, several red streaks converging from the neck and shoulders to the middle of the chest-bone, and passing over the abdomen until they were lost on the pubes, and there were similar streaks radiating on each hip in different directions until they were lost in the skin. It appears that this boy was in a sitting posture when struck. The hair on the back of his head and neck was singed, but his clothes showed no traces of burning nor the metallic buttons of fusion. The boy became conscious in five hours, and rapidly recovered. The red streaks gradually disappeared, leaving streaks of a scaly glistening white appearance, which culminated faded away altogether. (3) A man, aged 46, was, like the two others, in a sitting posture, and he appeared to have been killed on the spot; he had not moved. The countenance was placid, and the pupils were widely dilated. The discharge had produced a large *lacerated wound* of the scalp, but without causing any fracture. It appeared to have passed down each side of the head, between the soft parts and the cranium. On the left side it had passed downwards in front to the left ear, and terminated at the side of the neck, rupturing blood vessels and muscles and causing swelling of the parts, with effusion of blood. It presented the appearance of an extensive bruise caused by mechanical violence. On the right side the current had passed down to the space above the collar-bone causing lividity and swelling of the right ear as well as of the adjacent skin; and it terminated in a dark blue mangled patch of skin, in which there were several free communications with the surface. The hair on the back of the head was slightly singed, and that in front of the chest was singed quite close to the skin, but the hair

which covered the wound in the scalp was uninjured. The clothes, which were at the time very wet, were neither torn nor burnt, and the metallic buttons were not fused. The left side-pocket of the trousers contained several lucifer matches and a tin tobacco-box, which were unaffected. The right pocket contained a knife, which was strongly magnetic.

These cases present the effect of lightning in three degrees. The wound to the scalp and the injuries to the neck in the man killed might have been ascribed to the violence of another had not the circumstances been fully known. The clothes probably escaped burning or tearing by reason of their being wet, and thus readily conducting the electric current.

The following cases illustrate the features of some of the more common domestic and industrial forms of electrocution:—

A woman of 33, ignorant of electrical wiring, was found by her daughter on the floor, dead. One hand lay across the frame of an electric fire—which proved to be "alive". A screw-driver and pliers lay nearby, and it appeared the woman had been effecting a repair. The earth and one live wire had been connected to the wrong terminals. Local burns to the hand were present.

A boy of 16 was heard to scream shortly after going upstairs to have a bath: he was found unconscious in an electrified bath into which a hair drier had fallen. His mother had used the apparatus earlier that day, and it was not faulty. Artificial respiration and resuscitation in an "iron lung" were unavailing. No signs of drowning were found at autopsy. The most painstaking inspection of the body failed to reveal any electric or other injury.

A man repairing a "grab" machine in a amusement arcade was found dead between two machines, with a two-pin plug gripped tightly in his right hand, the pins buried in the depths of two penetrating electric burns: the proprietor got a shock when trying to release him, and the lead was found to be defective.

Suicides occasionally use the domestic electrical system for self-electrocution:—

A man of 33, in financial difficulties, sly, introspective and morose, was found dead in bed as a result of a letter sent to the Paddington Police Station indicating his intention to commit suicide. Electric fuse wire was tied round both wrists and the left ankle was connected by a wire to a water pipe. The wrist circuit was interrupted by an alarm clock, set to "contact" at 4 a.m. with the domestic 220/240 AC circuit.

A man of 45 was brought, decapitated, into Guy's Hospital. He had been seen by the driver of an underground electric train to "get down on to the track and place his neck across the live conductor rail" as the train ran into the Monument Station; it had been too late to pull up before striking him, but the driver had already seen flashes coming from the body as he approached it. Deep electric burns were found across the right side and front of the neck, set close to the margin of the rough grease-dirtied line of decapitation.

A case of some interest occurred in Dunedin, New Zealand, in which a young man accidentally slipped and fell on an electric lamp he was holding at the time, and died at once. The guard of the lamp caused a burn in the neck which passed to the windpipe, and its lower end lay on the right vagus nerve. There was no other trace of injury, and the organs were perfectly healthy. The floor was wet, and there was a leakage from the lamp of 50 to 70 volts. Death was attributed to heart failure from vagal inhibition.

Wireless Aerials and Lightning Injuries. A case is recorded in which a young woman was struck by lightning through an earthed wireless aerial. The report was as follows:—

A young woman was said to have been struck by lightning. Over the right hip she had a large bruise about 6 inches in diameter, with a central area of scorching.

[4]Edwards, W. 1925. *Brit. med. J.,* 2, 294

She was also *suffering from a mild degree of shock. Her clothes were quite uninjured.* At the time of the accident she had been standing close to the "lead in" of the wireless aerial. This had completely fused, and it seemed to be the flash from the fusing wire which had done the damage. *She described it as seeming as though the* whole of her right side had caught fire.

Considerable damage had been done to the window frame at the point where the wire entered the house, and bricks had been dislodged from the wall, this although the aerial was "earthed" by a switch inside the house. Apparently this common form of protection against lightning risks may be insufficient.

The aerial, which was of seven-strand copper wire, was fused in several places.

The Marconiphone Company commented on this as follows:—

"Our opinion is that a wireless aerial properly erected and well earthed with a good earthing switch, which is kept clean, or by means of plug-in contacts which are kept clean, is a distinct safeguard during a thunderstorm, as the aerial will cause the potential strain between the thundercloud and the aerial to be lowered, due to discharge from the aerial, so that a lightning flash will not take place between the cloud and the points immediately in the vicinity. This is the principle of the lightning conductor.

"However, *it is possible, due to sudden changes in cloud formation during a* thunderstorm, for the potential to rise so rapidly that even this protection will not lower the potential quickly enough to prevent a flash taking place, and then, of course, a certain amount of damage may be done."

LEGAL RELATIONS OF LIGHTNING AND ELECTRICITY

Cases of suicide are uncommon (*vide supra*) and homicide rare, but electric current has been employed for both purposes. In recent years one case has occurred in which attempted homicide was proved and in more than one death has occurred as the result of a prank or malicious practical joke.

Breitenecker, L[1] quotes a case of suicide in which a man killed himself by throwing a wire over an overhead electric cable. His hand was completely severed and thrown some distance from the body.

In 1925, a boy in Glasgow was killed as a result of a practical joke. The handle of a hut which he had to enter was connected with an electric light switch. When he touched the handle he uttered a cry and fell to the ground in an unconscious condition. Death occurred 15 minutes later. Such a "prank" might well incur a criminal charge.

In *R. v. Wybrow* (Chelmsford Assizes, 1951) a man was charged with the attempted murder of his wife for whom he had set a trap in the bathroom. He had diverted a circuit in the house in order to lead an alternating 220/230 volt 50 cycle current to the bathroom, drilling two holes in the wall behind the metal soap dish, which was thereby made "alive". He could turn on the current from his own room and had done so on several occasions, his wife receiving a number of shocks which had resulted in her calling in an electrician. She did not, in fact, collapse or suffer any grave harm, but the intention was so plain that a jury convicted the accused.

From the *post-mortem* appearances it would be impossible to ascertain by medical evidence whether a person had been wilfully killed by electricity; it must be decided entirely by circumstantial evidence. One could imagine a murderer possibly persuading his victim to touch dangerous live wires or placing him in such a position that he was exposed to a fatal shock.

The first execution by electricity was recorded as follows:—

"In August, 1890, a murderer, Kemmler, was judicially executed by electricity at Auburn, U.S.A., the current being introduced into the body at the shaven scalp. At the necropsy there was a well-defined circle at the top of the head where the skin had been scorched, and a circular spot four inches in circumference on the small of the back where the second electrode

¹ Internat. Kong. ger. Med., Bonn, 1938.

had been applied. The body was much burned, and became rigid within an hour of death. On the brain and beneath the spot where the electrodes had been applied, the blood was burnt to a carbonaceous mass. The spinal cord, brain, muscles, heart, and abdominal organs were normal.[1]

Experience has, of course, resulted in improvements in the technique of electrocutions and burns do not now occur.

CHAPTER XIII

DEATHS CONNECTED WITH COLD AND HEAT, SPONTANEOUS COMBUSTION, VITRIOL THROWING

EFFECTS OF COLD

THE effects of cold upon the human body may be local or general, and the severity of such effects depends mainly on the intensity of the cold and the duration of exposure. Local and general effects are, of course, frequently found together.

Local Effects

The localized effects of cold, a subject attracting much interest among pathologists and clinicians in wartime, comprise the conditions known as frostbite, trench foot and immersion foot. This nomenclature reflects the different environmental factors involved in the etiology of the conditions, but exposure to cold is the fundamental factor in all three. Trench foot and immersion foot are almost certainly one and the same thing, namely, that condition which affects the extremities as a result of prolonged exposure to severe cold and dampness, such as is typically experienced by soldiers during winter warfare, especially in trenches, and by those subjected to prolonged immersion or exposure at sea. Cold is the determining factor, of which the dampness can be regarded simply as adjuvant. Frostbite is the corresponding condition due to exposure to greater extremes of cold, with which a relatively dry environment is more common. Frostbite can develop more rapidly than trench foot and, in addition to the extremities, it more frequently affects other parts, e.g., nose, ears, and even the relatively flat surfaces of the face.

The underlying pathogenesis is not yet fully understood, but is no doubt similar in all three conditions. In connection with their work on immersion foot, the term "peripheral vaso-neuropathy after chilling" has been suggested by Blackwood and Ungley,[1] and the term would seem applicable to the other conditions also. The effects of cold on the vascular tissues and the vascular innervation of the extremity result in an ischæmia sufficiently severe to cause tissue damage. This damage is, perhaps, aggravated by the inability of the available hæmoglobin to liberate oxygen because of the depressed temperature in the affected part. Swelling and œdema result from loss of fluid through damaged vascular endothelium, while corpuscular "silting-up" and agglutination[2] occur within the capillaries. Thrombosis may follow later as a secondary phenomenon. As a result of such changes, the local capillary circulation may remain impaired even after removal to a warmer environment, and the persistent anoxia is rendered still more damaging by reason of the increased metabolic requirements of the tissues at a higher temperature. Spasm of the arteries and persistent œdema may greatly retard revival of the parts.

[1] Blackwood, W., and Ungley, C. C., 1912. *Lancet*, 2, 447.
[2] Greene, R., 1943. *J. Path. Bact.*, 55, 259.

From a clinical point of view, the results range from transient, reversible changes, through a variety of lesions which recover to varying degrees by slow regenerative processes, to complete tissue loss by gangrene. From a medico-legal point of view, the only significant observation to be made is that many of these changes can only occur in tissues which are living at the time of exposure. Hence, if severe "vitalized" local effects of cold are discovered on a dead body, it is conclusive medical proof that the person was living when they were produced.

In the stage of first aid, the important thing is to remember that sudden warmth may aggravate the damage. The body should be well wrapped and warmed, but the affected parts kept cool and dry. Wet cold and friction are harmful, and the traditional procedure of rubbing with snow is therefore not to be advocated. Elevation of the affected limbs may be beneficial.

The period of disability depends, of course, on the clinical severity of the case, and varies therefore from a few days or weeks to many months. The possible sequelæ, which may in some cases constitute a considerable disability, include persistent circulatory deficiency, with cold sensitiveness and cramps, recurring pain, tingling and swelling, hyperidrosis, and late blisters, or even ulcers and gangrene.

The subject is reviewed in "Modern Trends in Forensic Medicine".[1]

General Effects

The general effects of cold are more likely to be the subject of medico-legal enquiry—and occasionally of criminal procedure.

Protracted exposure of the human body to a low temperature may cause death; and although in Britain cases but rarely occur in which cold alone operates fatally, it is not unusual during a severe winter to hear of persons, in a state of ill-nourishment and destitution, being found dead in exposed situations. Accidents in mountain-climbing are sometimes recorded in which death is due to simple exposure.

Uttley[2] recorded the case of three girls who died of exposure in a New Zealand mountain pass. The bodies were stiff and fresh 60 hours after death. A pink mottling of the skin was a striking feature, especially of the legs and forearms where there was a marked oedema. The pericardial sacs each contained some 100cc of proteinous fluid and infarcted areas were found in the lungs. The blood vessels showed the margination and "silting-up" with hæmolysis described by Greene.

On these occasions one may sometimes suspect that the lack of proper food and nourishment has accelerated death. It is, however, important to make a distinction between the effects on the system of cold on the one hand, and starvation on the other, as the symptoms preceding death and the rapidity with which it takes place are different in the two cases. According to the Registrar-General's report for England and Wales in 1951, there were ten deaths at all ages due to exposure to cold, including six males and four females.[3] From time to time a charge of murder or manslaughter from the same causes is made, but proof of the wilfulness of such acts is difficult and charges are rare indeed.

Symptoms of Exposure to Cold. A moderate degree of cold is well known to have an invigorating effect upon the body; but if the cold be severe,

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[1] Modern Trends in Forensic Medicine. 1953. Ed. Keith Simpson. London: Butterworth & Co.
[2] Uttley, K. F. M. 1948. N.Z. med. J., 47, 427.
[3] This does not include cases listed under "Hunger, Thirst and Exposure".

and the exposure to it long continued, while the animal heat is not maintained by warmth of clothing, exercise, or food, the skin becomes pale, and the muscles become gradually stiff and contract with difficulty, especially those of the face and extremities. Sensibility is lost, and a state of torpor ensues, followed by profound sleep, from which the person cannot be readily roused; in this state of lethargy the vital functions gradually cease, and the person finally perishes. Such are the general effects of intense cold upon the body. Its influence on the nervous system is seen in the numbness, torpor, and sleepiness which have been described as consequences of a long exposure to severe cold. Giddiness, dimness of sight, and paralysis have in some cases preceded the fatal insensibility. It was observed during the retreat of the French from Moscow in 1812 that those who were most severely affected by cold, often reeled about as if in a state of intoxication; they also complained of giddiness and indistinctness of vision, and sank, under a feeling of lassitude, into a state of lethargic stupor, from which it was found impossible to rouse them. Convulsions, followed by rigidity of the whole of the voluntary muscles seized the individual, and he rapidly fell a victim. Anoxic symptoms indicative of a disturbance of the functions of the brain and nervous systems have also been experienced by mountaineers during ascent to great heights, as on the successful Everest expedition.[1]

Cause of Death. At low temperatures, tissue metabolism is diminished, and when cooling of the body becomes general, owing to prolonged exposure to severe cold, the cells of the central nervous system must share in this lowering of activity. Moreover, at low temperatures, the capacity of hæmoglobin both to take up oxygen and to release it is modified. Less oxygen is taken up from the atmosphere, but once taken up, it is less readily dissociated. In the body, both factors contribute towards a tissue anoxia which depresses cellular vitality still further. The results of this on the central nervous system are reflected in the progressive latitude, defective cerebration and other nervous symptoms, and as the vital centres become more severely affected, there is slowing of the heart and respiration rate. Death results from the ultimate failure of the vital centres, and at body temperature of around 29–30°C.

Circumstances Accelerating Death in Exposure to Cold. The degree of cold and the duration of the exposure are obviously the main factors which determine the effects produced, but it would appear also that cold has a more depressing influence under wet or damp conditions than when the air is dry. In Critchley's series of cases from the Second World War[2] only one man out of ten survived half an hour at 1·7°C.; some 22 hours at 5–8°C., was sufficient to cause immersion hand and foot changes. Moreover, there are marked individual variations in susceptibility to cold. The over 40's and under 17's suffer more severely; infants, especially when newly-born, perish quickly from exposure to cold. Among the intervening age groups which comprise the majority of mankind, most writers on the subject agree that the greater susceptibility is found in individuals of the fat-deficient, asthenic, vago-tonic type. The explanation may lie partly in the absence of fat, but even more in the neuro-vascular endowment of such individuals. In this connection, an observation of Koch has been quoted, namely that "cardiac vago-tonics are potentially circulatory sympathetico-tonics". Conversely,

[1] The Ascent of Everest. 1953. John Hunt. London: Hodder & Stoughton.
[2] Critchley, M., 1943. Shipwreck Survivors. London. J. & A. Churchill.

the short, stocky, type of individual is generally less vaso-labile, more resistive to cooling.

The contributory effects of wounds and blood loss, or other conditions associated with shock, can be readily understood. The grave combined effects of exposure to cold and wound shock are very familiar to all who have been responsible for the early treatment of battle casualties.

In all cases in which there is exhaustion of the nervous system, as in those who are worn out by disease or fatigue, in the aged and infirm, or again, in persons who are addicted to the use of intoxicating liquors, the fatal effects of cold are more rapidly manifested than in others who are healthy and temperate. It has been generally remarked that whenever the nervous energy is impaired, either by intoxication or exhaustion from fatigue, a man dies quickly from cold. The exposure of drunken persons during a severe winter night may therefore suffice to cause death, although the cold may not have been so intense as to affect others who were temperate. Casualties of this nature sometimes occur during the winter season; and a knowledge of the influence of intoxication in accelerating death in such circumstances may occasionally serve to remove a doubt in the mind of a medical man respecting the real cause. Alcohol is well known to cause a flushing of the skin, and hence a greater loss of heat.

Post-mortem Appearances. The skin is commonly pallid, with patches of redness on the cheeks, the lips and other exposed parts. They are not found on covered areas. The viscera of the chest and abdomen as well as the brain is congested with blood. The blood is often of a bright red colour, suggestive of carbon monoxide poisoning due to the retention of oxygen by hæmoglobin at low temperatures.

The appearances of death from cold, cannot be regarded as characteristic, and there is always some difficulty in deciding whether death has taken place from that cause. The season of the year, the place and circumstances in which the body is found, together with the absence of other possible causes of death (such as from injuries or internal disease), form the only basis for a medical opinion. Death from cold is seldom determined without negative or presumptive evidence; for there is little organic change, either externally or internally to enable a medical man to give a positive opinion on the subject. The silting of cells in the vessels, the hæmolysis and local cellular œdema described by Greene (1943)[1] are strongly indicative of death from cold.

With reference to the florid condition of the blood, it must be remarked that this is observed only while the body remains at a low temperature; it depends on the retention by the hæmoglobin of its oxygen at this low temperature. This bright red hue of the blood *in the heart*, if carbon monoxide and nitrites are excluded, strongly suggests death from cold. It is not produced internally by exposing dead bodies to the influence of a low temperature, because the atmospheric oxygen cannot diffuse itself so far internally as the heart.

Microscopy of discoloured extremities may show the characteristic silting-up of the red cells in the vessels and of peri-vascular œdema with lymphocyte infiltration.

If putrefactive changes have commenced before the body is exposed to a low temperature, the characteristic colour does not appear, because tissues undergoing decomposition are active deoxidizers.

The influence of cold on putrefaction is fully dealt with elsewhere (p. 187).

[1] Greene, R., 1943. *J. Path. Bact.*, 55, 259.

Medico-legal Relations of Death from Cold

There is but little on this subject noteworthy in the annals of crime, although the following cases show that such do occasionally occur:—

A man and his wife were tried for the murder of their daughter a girl aged 11, in the following circumstances: On December 28th, at a time when the weather was severe, the woman compelled the child to get out of her bed and place herself in a vessel of ice-cold water. The child cried and endeavoured to escape from the bath, but she was by violence compelled to remain in the water. The child soon complained of exhaustion and dimness of sight; the female prisoner then threw a pail of iced water upon her head, soon after which the child expired. Death was attributed to the effects of this maltreatment, and the woman was convicted.

In the "War Trials" that followed the Second World War the War Crimes Commission produced evidence of a series of experiments carried out on human subjects under detention. They were exposed to dry cold, naked, for nine to fourteen hours at a February temperature of -6°C. and, varyingly clothed, to immersion in water at 4-9°C until unconscious or dead. No possible defence could be put forward for such cold atrocities of treatment.

In 1918 two charges of manslaughter and others of lesser degree were made against an R.A.M.C. officer in respect of his treatment in a detention camp of nine patients. The inmates of this "refractory prisoners" block had only 900 calories per day, inadequate clothing and no heating—during a winter period. Frostbite, gangrene, respiratory infections and tuberculosis which developed were, it was alleged, neglected, death ensuing as a consequence. Skilful defence resulted in the manslaughter charges being unsuccessful, five negligence charges being found proved.

Exposure to degrees of cold not in themselves very severe may so lower the resisting power of the individual that death results.

A man and a woman were sentenced to 15 years' and 5 years' penal servitude respectively for ill-treating a child of eleven by starvation and exposure in winter in a bedroom where there was no fire. The fact that the child was insured for £25 supplied the motive, and probably accounted for the severity of the sentences.

Foundlings frequently die from exposure in this way, even when some care seems to have been taken to wrap them.

Thousands of lives are lost at sea and elsewhere in times of war through a combination of cold with exhaustion, rather than from actual drowning, although they may be certified as drowned. Breathing air many degrees below freezing point has no ill effect when breathing takes place through the nose, but when exertion compels rapid mouth breathing, the lungs may become damaged.

EFFECTS OF HEAT

Injuries from heat, as from cold, present themselves in two forms—local burns and general exposure to heat. We shall discuss the points in the following order:—

A. *Local Burns and Scalds*—Types.
 Symptoms, Pathology and Cause of Death.
 What caused the Burns?
 Was Death due to Burns?
 Was the burning Accidental, Suicidal, or Homicidal?
 Time required to burn a body.

B. *General Exposure to Heat.*
 Heatstroke and Sunstroke.

Local Burns and Scalds

Varieties of Burns. A *burn* is an injury or wound produced by the application of a flame or heated substance to the surface of the body: a *scald*

results from the contact of a liquid at a dangerously high temperature in the same circumstances. There is no real distinction between a burn and a scald as to the effects produced on the body. The injury resulting from boiling mercury or melted lead might receive either appellation. Nevertheless, as a matter of medical evidence, it may be important to state whether the injury found on a body was caused by such a liquid as boiling water, or by a heated solid. If the former, the injury might be ascribed to accident; if the latter, to criminal design. A scald produced by boiling water is indicated by erythema, vesication and a sodden state of the skin, but there should be no destruction of substance, nor should there be any singeing of the hairs. In a burn by a heated solid, the parts may be more or less destroyed, or even charred; the cuticle may be found blackened, dry, almost of a horny consistency, and presenting a shrivelled appearance. The hairs may be singed or distorted. This distinction applies only to scalds from water. A scald from melted lead could not be distinguished from a burn produced by a solid heated to the same temperature. Some oils boil at 250°–300°C., and they produce burns as severe as those caused by melted metals. Burns from flame are indicated by scorching of the skin and singeing of the hair, while burns from gunpowder are known not only by the scorching, but by the small particles of unburnt carbon which are embedded in the skin. *Burns from corrosive substances* are usually free from blisters, may show distinctive coloration and have distinctive chemical reactions. *Electrical burns* have been described in some detail in the section on Death from Lightning and Electric Currents (p. 407). To sum the matter up, we may say generally that the temperature to which the body has been exposed, the extent of surface exposed, and the duration of exposure are the only points that materially affect results, except where chemicals and electricity have been concerned.

Degrees of Burns. Burns have been clinically divided into six degrees of severity, following a classification suggested by Dupuytren:—

First Degree. The heat produces a simple inflammation of the skin The skin is red, but the redness disappears on pressure; there is slight and superficial swelling, with severe pain, relieved by the contact of cold substances. The inflammation subsides after a few hours, and the skin resumes its natural condition; or it may continue for several days, and the cuticle then peels off.

Second Degree. Blisters are formed, some which appear *immediately*, others within 24 hours, and those which are already formed become enlarged. Suppuration takes place if the cuticle is removed and the person survives sufficiently long. As the cutis, or true skin, is not destroyed by this degree of burn, there is *no mark or cicatrix left on healing to indicate its past existence.*

Third and Fourth Degree. The cutis is partially or completely destroyed. The burn appears in the form of yellow or brown patches. An inflammatory redness, accompanied by vesication or blistering, is present around the burnt area. The skin appears shrivelled and puckered towards the eschar, which is depressed below the surface. From the fourth to the sixth day the scab becomes detached, leaving an ulcerated surface, which heals slowly, and is always indicated by a scar, from the nature of which the depth and gravity of the burn may be judged for purposes of medical evidence.

Fifth and Sixth Degree. In the fifth and sixth degrees, the whole of the skin, the subcutaneous tissues, and more or less of muscles and even bones, are converted into a general eschar. The appearances are similar to those of the fourth degree, but in a more aggravated form. The burnt part is completely charred. If the person survives, inflammation is set up in the subjacent tissues and organs.

Wilson¹ has simplified the classification by reducing it to three degrees—

¹ Wilson, J. V., 1946. The Pathology of Traumatic Injury. Edinburgh E. & S. Livingstone.

(a) epidermal, (b) dermo-epidermal, and (c) deep burns, and there is much to recommend this estimation of academic detail.

SYMPTOMS, PATHOLOGY AND CAUSE OF DEATH IN BURNS

Intense pain is the principal symptom, and is more severe in superficial than in deep burns, owing to the greater implication of nerve endings. This pain is no doubt responsible for a degree of initial shock immediately following the injury, but this merges rapidly into the stage of secondary shock associated with loss of protein and concentration of the circulating blood, together with a striking elevation of the non-protein nitrogen. Pain becomes less severe, but thirst is a marked feature owing to fluid loss, and vomiting is common. Deaths from shock occur in the first 48 hours, and comprise more than half of the deaths from burning. If the patient survives, the symptoms change to those of oligaemic anoxia and metabolic imbalance due to the vast loss of protein. The temperature rises, oliguria becomes marked, and the patient is dangerously ill. Vomiting may persist, and muscular spasms or frank convulsions occur. The mental state may be one of irritability or delirium, deepening into coma. Deaths due mainly to secondary shock and toxaemia occur characteristically on the third or fourth day after injury. Thereafter the chief danger to life is the occurrence of sepsis in the burned areas, with consequent septic absorption. The signs and symptoms are then those of any septic toxaemia, and the *post-mortem* findings in fatal cases will be those typical of prolonged sepsis.

In spite of much experimental and clinical work within recent years, the complex pathology of burning is still not fully understood. There is no general agreement to the incidence of the various *post-mortem* findings that occur, nor on the interpretation to be placed upon them. The same may be said of the many changes in blood chemistry which have been noted; even the mechanism of shock production in burns cannot be regarded as established beyond argument.

At *post-mortem* examination, the affected area of the body will be found reddened or charred, although the appearances may be modified by the treatment which has been applied. Hair may be found singed or bulbous at intervals. There may be blisters, either ruptured and collapsed, or tense with fluid of a highly albuminous nature, and often of a jelly-like consistency. Certain of these conditions will be fully considered later.

Except where death is due to anoxia and inhalation of CO, apart from the local pathology of the burned area, there are no *post-mortem* findings which can be regarded as invariably associated with and pathognomonic of death by burning. Haemoconcentration is usually present in cases which have died within the first few days after injury, and there is frequently an excess of fluid in the serous cavities. Congestion and oedema of the brain have been described, and scattered petechial haemorrhages of anoxic type are frequently found in various organs, but especially in the gastric and duodenal mucosa and under the pleura, endocardium and pericardium.

Necroses in the liver have been described, even in cases dying early; changes ranging from inconspicuous fatty change, to a central lobular necrosis which was formerly considered a specific effect of the acute toxaemia of burns. This opinion, however, was not universally endorsed by investigators, and it has now been shown that, this is largely, if not entirely, due to substances like tannic acid for their treatment (Rae and Wilkinson[1]). This is true also of

¹ Rae, S. L., and Wilkinson, A. W., 1944. *Lancet*, 1, 332.

the changes which have been noted in the kidney, equally variable and ranging from cloudy swelling to necrosis and calcification.

In the present state of our knowledge, the position may be summarized by saying that severe burning causes severe shock which may prove fatal, and also gives rise to an acute and sometimes fatal toxæmia due to the absorption of histamine-like substances from the burned area. Degenerative changes and dysfunction of various organs, notably the liver and kidney may ensue.   If the toxæmic stage is survived, the chief danger to life is from sepsis or intercurrent disease, especially of the respiratory system.

Ulceration of the Alimentary Canal. Curling was the first to call attention to the occurrence of duodenal ulcers after burns; numerous cases have been recorded both *in vivo* and *post-mortem* after burns. Congestion of the stomach and duodenum, often with erosions, occasionally acute ulcers, is a more common *post-mortem* finding.

In a case in which a woman died on the 13th day after a superficial burn involving the skin of the lower part of the body, the stomach was found inflamed in the cardiac part, and the duodenum at its lower portion. The small intestines as far as the cæcum were also more or less inflamed.

In a Welsh civil case, it was shown that a man had sustained severe burns from an explosion of fire-damp in a coal mine. He partially recovered from the first effects, but lingered for nearly three months, when he died, according to the medical evidence, from inflammation and ulceration of the bowels. There was no other apparent cause of this inflammation but the burns, and death was referred to the burning as the primary cause, there being no actual recovery from the time of the occurrence until death.

The Colour of the Blood. In examining the bodies of victims of fire accidents, the blood is often found to be cherry red in colour and shows the reactions for carboxyhæmoglobin. When this is so, it is probable that carbon monoxide poisoning was at least partly responsible for death, and may confirm that the person was alive when burning took place. Saturations of 30–50 per cent HbCO are common.

Carbon Particles in the Lungs. The mucous membrane of the nose, nasopharynx, larynx, trachea and bronchi, must be carefully examined for carbon particles inhaled with the smoke, for their presence is strong confirmatory proof that the victim was alive when the fire occurred.

In examining the bodies of fire accident victims, especially in aircraft disasters it may be necessary to note carefully all matters concerned with identity. The burning of the S.S. Noronic whilst at dock in Toronto Harbour in 1950 provided, among the 119 victims, substantial problems in the identity of charred remains, of which Singleton[1] has given a description, to which the reader is referred. The bones are never completely destroyed. They become white, and portions of them retain their form even under the action of a most intense heat, as in cremation.

THE NATURE OF THE SUBSTANCE CAUSING THE BURNS

Among the questions which have arisen in reference to a body found dead from burns is this: whether the burns have been caused by fire, by hot or molten metals, by hot liquids, by inflammable substances such as paraffin, petrol, etc., or by gunpowder. Paraffin, petrol, etc., may be recognized by the odour, and it is often possible to extract some of the material from the

[1] Singleton, A. C., 1951. *Amer. J. Roentgen.*, 66, 375.

clothing or nearby furniture, as was done in the case of *R*. v. Rouse (Northampton Assizes, 1931).[1]

Burns from the explosive flame of gunpowder are generally characterized by the introduction of some of the grains into the substance of the skin. In the Morfa colliery explosion in 1870, it was of some importance to determine whether gunpowder or fire-damp had caused the death of some colliers. There was considerable difficulty in the case because explosions from gas in mines generally cause a blackening of the skin from the coal dust.

It is quite obvious that little evidence is likely to be obtainable as to causation from the burn itself if caused by a flame, the only condition for the production of a burn being a sufficient temperature. The thermal and ionizing radiations of atomic explosions have not yet become matters of medico-legal interest.

The recognition of a scald from water presents little difficulty, and the scar of such an accident is usually characteristic. The distribution of scalds *running down the trunk and limbs in lines suggests a liquid.*

Burns from hot metals cannot be distinguished from those produced by a flame, unless the shape of the burn may indicate the shape of the hot metal.

MEDICO-LEGAL QUESTIONS CONCERNING BURNS

The principal question on which medical evidence is required on these occasions is whether, in a dead body found burned, the burning took place

FIG. 48. Charred body of woman found dead on bed amid personal belongings including partly burned matches and a taper. Note contracture of R. leg from heat causing a posture raising suspicion of assault.

[1] Notable Trials Series. Alfred Arthur Rouse, 1931. London: Hodge & Co.

during life or after death. As bodies are sometimes burned in order to conceal criminal acts of violence, a careful inspection should be made to determine whether there are indications that violence has taken place. The ability to answer these questions must depend on the degree to which the fire has destroyed the tissues. The remains may be so charred as to suggest that the investigations will be unrewarding, but a most careful autopsy should be made in every case. It is never too late for an autopsy.

In the "Chalk Farm Murder" (*R. v. Furnace*, 1933), a charred body was found seated in a chair after a fire had been put out on a builder's premises. A note was found in the outer office which read "Good-bye to all. No work. No money. Sam S. T. Furnace". The premises belonged to a man named Furnace who was known to be in debt, particularly to a man called Spatchett. The police informed Mrs. Furnace that her husband had been found dead, *but autopsy next day revealed a bullet wound in the back*. Laundry marks on the shirt indicated that it belonged to Spatchett—, who had also disappeared, and the dental data were recognised by Spatchett's *dentist. Furnace was traced to Southend and arrested. He committed suicide* whilst under detention awaiting trial.

Homicidal burning cannot, however, always be established by medical evidence so much as by that which is presumptive or circumstantial; but there are many medical questions which arise out of the circumstances in which a dead body is found burned. Some of these must now be considered:

Was Death due to Burning, or was the Body burnt after Death

In considering the similar question put in cases of drowning, hanging, strangulation, and suffocation, it is but very rarely indeed that medical evidence will be the most important, owing to the circumstances, but in cases of fatalities in fires we must enlarge upon the matter owing to its importance in an obscure case.   A final conclusion will depend upon several factors, which must be taken separately, and may be enumerated as follows:—

    Can a burn be distinguished from other injuries?
    Was a given burn sustained during life or after death?
    How long did the victim survive?
    What extent of burning is likely to be fatal?
    Are there specific indications that death was from burning?
    Are there any other appearances to account for death?

Are the Lesions due to Burning? When once the epidermis has been removed from an area of skin by any means, the affected area will dry after death, becoming a yellowish-brown patch. Hence it is quite possible to mistake a small burnt area for a simple graze unless the temperature to which the area was exposed was high enough to singe some of the surrounding hairs.

If large areas are involved, it is impossible to mistake a burn or scald for some other wound of superficial character, and if the lesion be deeper, it is almost certain that there should be some scorched and roasted flesh, the smell of which is unmistakable.

In general, wounds caused by cutting or blunt weapons are readily distinguished from burns, but, nevertheless, the question may often arise owing to the fact that burnt tissues are easily cracked by movement, and the skin and deeper tissues may split as a result of the heat. These fissures may sometimes strongly resemble lacerated wounds.

A boy, two years of age, was taken to the London Hospital so severely burned on the face, neck, abdomen, and limbs, that he survived the accident only three-quarters of an hour. A suspicion of ill-treatment having been excited by the appearance of wounds about the knees, which were observed as soon as the child was admitted, and by the reported neglect and ill-usage of the child by his step-mother, an inspection was made. The body was plump and well formed. The skin in the burned parts was deprived of cuticle and converted into a hard dry yellowish or blackish mass, which was very tense, taut, and easily torn. There were gaping splits on both knees. On the right side a fissure in the skin commenced about the middle of the thigh and proceeded for two inches and three-quarters to the inside of the patella, where it became somewhat jagged, and making a sudden turn inwards, passed towards the back of the joint. A transverse laceration of the skin, three-quarters of an inch in length, was observed on the front of the left thigh a little above the left knee, and another, which was also transverse and measured an inch and a half in length, was situated below on the inner side of the joint. These fissures in the charred skin exposed the fatty tissue beneath, which was white, and free from any effusion of blood. The edges of these fissures did not present the clean and smooth appearance usually observed in incised wounds. From the absence of any trace of effusion of blood, the sound condition of the exposed adipose tissue, its exemption from the action of the fire and the irregular character and appearance of the fissures, it was quite clear that they were not the result of wounds inflicted before the occurrence of the burn.

The influence of heat had dried and contracted the skin, completely destroyed its elasticity, and the superficial layer of fatty tissue, being closely adherent to it, necessarily gave way at the same time. In several places some small vessels containing blood were observed running across the fissures; these, being more tenacious than the fatty tissue, had not yielded with it. This appearance alone was sufficient to exclude wounds by cutting instruments.

Artificial or post-mortem fissures of the skin in cases of death from burns are now well understood.

Was the Burn Ante- or Post-mortem?

After a murder has been perpetrated, it is not uncommon for a criminal to attempt to dispose of the body by burning it. It is, therefore, very important for the medical witness to be acquainted with the differences between a burn inflicted during life and a burn on a body already dead. Usually the body is not burned until all signs of life have disappeared; in such cases there is nothing but the charring of dead flesh, so that there can be no difficulty in forming an opinion.

A man collapsed—of a ruptured cerebral aneurysm—and died a few minutes after a domestic squabble had started: a few ineffective blows had been sustained by each party. At autopsy two large *post-mortem* burns, completely devoid of any vital reaction, were found over the lower front chest and left upper abdomen. Enquiry revealed that the aggressor, anticipating a police charge in the event of his "having a death on his hands", had heated a flat iron and pressed it several times on to the body "over the heart" in an endeavour to revive the victim.[1]

In *R. v. Brown* (Leeds Assizes, 1935) a groom was charged with the murder of a farmer named Morton at Saxton Grange, Sherburn. He had isolated the farm by cutting the telephone cable with a knife proved by evidence to belong to him, and seen in his possession half an hour before an intense fire broke out in the garage: the almost completely burned trunk of a man was recovered among the charred remains of a car, and, at autopsy, this was found to have a bullet wound traversing the chest. Petrol was identified in the fire residue and Brown was convicted of the murder of the farmer by shooting him and subsequently setting fire to the body. It did not appear that life was present at the time the fire was started.

When the burning is partial, and has probably taken place from a wilful ignition of the clothing at or about the time of death, some caution is required in expressing an opinion. The principal points naturally turn on the signs of reaction which living tissues show toward burns. These are the production of vesicles and signs of congestion or inflammation.

[1] Keith Simpson, 1952. *Forensic Medicine*. London: Ed. Arnold & Co.

Blistering. The production of *vesication—i.e., of blisters containing serum—* is commonly regarded as an essential character of a burn which has been produced during life, but it is not a necessary or invariable effect of a burn on the living body. Vesication is especially observed in scalds, or in those cases in which the skin has been burnt by flames or by the ignition of the clothes, provided the cuticle has not been destroyed. It is not so commonly observed in burns produced by intensely heated solids. In vesication the cuticle is raised from the true skin beneath, and is converted into one or more blisters of exuded matter, while the skin around is of a deep red colour. It is uncertain as to the time at which it appears; it is usually produced in a *few minutes,* but sometimes not for several hours, hence death may take place before vesication occurs, and the non-discovery of this condition does not warrant the opinion that the burn could not have taken place during life. If the cuticle is removed from a vesicated part of the living body, the skin beneath *will become intensely reddened,* but *if the cuticle is stripped off a dead body,* the skin will become hard, dry, and of a yellow colour; it does not acquire the intense scarlet injection which is acquired by the living skin when vesicated and exposed.

There have been conflicting opinions whether the presence of blisters on a dead body should be received as an absolute proof of burning during life The following may be taken as a summary of the ascertained facts:—

A young man had poisoned himself with opium. While he was lying in a state of coma, four hours before death, a hot iron was held on the outside of the hip joint; and half an hour after death, a red-hot poker was applied to three places on the inside of the arm. Vesication followed the burns in both instances, but those caused during life contained serum, and those which were formed after death *gas.* In a second experiment a cauterising iron produced no blisters on a leg half an hour after amputation, but vesications containing gas were formed when the iron was applied ten minutes after amputation. Christison thought that a vesication containing serum indicates a burn during life, and one containing a gas burn *after death.* Taylor performed some experiments on the bodies of infants 18 and 20 hours after death, both with boiling water and heated solids, but in no case did he observe any kind of vesication to follow at that period. The skin was shrivelled, and was partly destroyed by the heat, but no blisters were produced.

In certain morbid states, blisters containing serum are said to have been produced in the dead body even 24 hours after death.

Leuret observed that this took place in an œdematous subject in the vicinity of which a heated brazier had been placed. The cuticle was hardened, then raised and blistered, and the blister contained an abundance of reddish-coloured serum. In repeating this experiment on other dead bodies not œdematous, it was observed that no vesications containing serum were produced. Champouillon found that blisters may be produced in bodies affected with general dropsy at almost any period after death. The blisters did not appear immediately; the time which he found requisite for their production varied from two to six hours. The serum effused beneath the raised cuticle was rarely tinged with blood.

The conclusion to be drawn from these experiments is that, in the examination of *burns* on the body of a person affected with general dropsy, it is necessary to be cautious in expressing an opinion. In such cases it would not be possible, from the existence of mere vesication, to say whether the burn took place before or after death.[1,2]

Christison found that when boiling water was poured upon a dead body *ten minutes* after death, the skin was simply ruffled and shrivelled, but the

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[1] Gonzales, T. A., et al., 1954. "Legal Medicine". 2nd Ed. Appleton Century, N.Y. p.533.
[2] Jantric-Jelaeue, O., 1954. *Amer. med. leg.*, 54, 63.

cuticle was not raised into a blister. The same effects were produced so long as the body was freshly dead. It is improbable that any effects closely resembling an *ante-mortem* blister can be produced by heat applied after death.

Chambert has published the results of numerous experiments on the effects of burns on the living and dead body. These were made on the bodies of persons from the moment of death until 20 hours after dissolution, and some were performed before death. The general results of his researches are—that blisters may be produced by burns, both on the living and dead bodies; that they are produced at a lower temperature in the living than in the dead; that in the living a burn produces great capillary congestion, with effusion of serum in the blisters, and that this serum, when heated or treated with nitric acid, sets into a nearly solid coagulum. The blisters produced in a dead body, even a few minutes after death, contained a thin watery serum, which was only rendered opaline or milky by heat or nitric acid, i.e., contained but very little albumen compared with the fluid obtained from the blister of a burn during life.

Fractured Skull and Intra-cranial bleeding in burns. Fractures of the skull and intra-cranial bleeding may occur when the head is subjected, *after death,* to intense heat. Several cases have occurred in our experience where grave suspicion of criminal violence has been raised by this finding, and Sampson[1] has drawn attention to these changes. Flaking of the burned skull vault, especially of its outer plate, may also be complicated by fissures due to heat distortion of the vault, and blood which is still fluid may be "boiled" out of the injured vessels between the skull and dura or under the membranes: the former is more common, and the more likely to arouse suspicion of *ante-mortem* injury. A most interesting case was brought to one of the authors for confirmatory opinion in 1932.

A fire broke out in a terrace of poor houses in Aberdare, Glamorgan, and a small cottage was gutted. When the conflagration had been got under control the charred remains of a woman of 55 and of her grandson of three and a half were found. The husband and a daughter (whose illegitimate infant the grandchild was) escaped, and surprise was expressed that the woman who met her death had not also escaped together with the grandchild. When autopsy was made by Dr. C. R. E. Freezer a large left temporal and frontal "hæmatoma" was found between the skull and the dura. Though Dr. Freezer indicated that such lesions were not uncommonly developed when the freshly dead body was exposed to a fire, and gave no cause in itself for suspicion, the police were disinclined to let the matter rest there. They had found out that the furniture had been insured for £400 (there were 50 insurance policies for small amounts), that the suspect husband had managed to save the insurance policies from destruction if not his wife. He had made a small claim for fire damage only two or three months previously.

There was no skull injury other than by fire, and a sample of the *post-mortem* hæmatoma blood was shown to contain HbCO in significant quantity: it was concluded that the victim had been alive at the time of exposure to fire fumes. The police were reassured and no charge was made.

its absence furnishes no proof, therefore, of the burn having been produced after death, Christison endeavoured to determine by experiment whether this line of redness could be produced by applying a heated iron to a dead body. He found that when the person had been dead only *ten minutes* no such effect was produced. In repeating these experiments on bodies many-hours after death, Taylor found that no line of redness ever presented itself; so that its discovery in a burned dead body would appear to indicate either that the burning took place during life or within a few minutes after death, most probably the former.

Wright considered that in a low state of vitality a line of redness might not be produced by a severe burn on the living body, and that more reliance might be placed on the red marks found beneath the blisters and crusts of vital burns. These latter were well marked when the line of redness itself was indistinct.

Though there is no sharp line of demarcation between them, it is important to note that this red line is not quite the same thing as inflammation which occurs at the edges and on the surface of a burn when the victim survives for some time; the degree and the stage of this inflammatory reaction is of importance in estimating the length of survival.

A microscopic examination of the injured tissues should be made in order to ascertain whether there are any signs of vital reaction or infiltration with leucocytes, which prove that the burns were sustained during life.

The presence of *carbon monoxide in the blood*, the presence of *carbon particles in the lungs*, and the observation of *toxic changes in the cells* of the viscera are most important points in deciding whether the person was alive or dead when the fire occurred.

How long did the Victim survive the Burns?

A person may die in a few minutes or live some hours after receiving a most extensive burn, and there may be little change in the part to indicate when death actually took place. There may have been no time for inflammation or its consequences to become established. Suppuration in severe cases may occur on the second or third day, but often not until a later period. In regard to gangrene, this takes place when the vitality of a part burned is destroyed and the time of its occurrence is uncertain; it sometimes very speedily follows the injury.

All that can definitely be said is this: inflammation can occur only in *living tissues*; therefore, if it is present, the patient must have survived long enough for reaction to set in. The stages of inflammation are variable in the rapidity with which they appear or follow one another, especially in burns, and therefore a very guarded opinion must be expressed as to the duration of life after burning; only an approximate estimate should be ventured in such cases.

fires; it proves no more than that the person was alive and breathing during exposure to CO.

Are there any other appearances to account for death? The only means by which this question can be answered is obviously to perform the necropsy with scrupulous attention to the details of wounds, signs of gaseous and other poisoning, of strangulation or any other form of violent death. Dutra[1] has reviewed the cause of death in full, and the reader is referred to his writing.

ACCIDENT, SUICIDE, OR HOMICIDE?

Death from burning is so painful and repulsive to the sane mind that suicide by this means in England is extremely rare, except among the insane. Cases are from time to time reported, however, of persons who saturate their clothes with paraffin or petrol before setting fire to themselves. In the East it is by no means an uncommon method of suicide.

Accident accounts for a very large proportion of all burns and scalds. Ignition of the skirts in women and girls, and spilling of a kettle of boiling water over children are very common causes of burns and scalds; breaking of cheap lamps, with explosion of the cheaper oils, is another fertile source, as is explosion of oil stoves.

Fires in houses and places of entertainment often produce a terrible holocaust of victims. Three such disasters occurred in North America between 1942 and 1950—the Cocoanut Grove (night-club) fire in Boston involving 491 deaths, the Texas City oil fire of 1947 causing between 500 and 600 fatalities, and the S.S. Noronic disaster at Toronto, in 1950, 119 deaths.

It should be noted that the Children and Young Persons Act, 1933, s. 11, makes it a punishable offence to leave a child in a room in which there is an open fire which is insufficiently protected.

Suspicion of foul play is often allayed by a careful examination of the scene—and autopsy:

A postman noticed smoke coming from a letter box of a flat in Chelsea whilst making his morning delivery. The police who were called found the flat filled with smoke coming from a burning settee in which lay the fore-part of the body of a man, extensively burned. His head and shoulders had become consumed so far as to be no more than a crumbling charred mass, quite unrecognisable, and the arms and mid trunk, still smouldering, lay over the edge of the settee, the legs sprawled over the floor. *The butt of a pistol stuck out from the mid abdomen and foul play was at once suspected as this is not a site of election for suicidal discharge of firearms. The body was photographed before being disturbed, the room was examined for prints* and other precautions were taken should the case prove to be criminal. Careful withdrawal of the "weapon" showed it to be a gas lighter pistol: the case was one of accidental burning. The old man, who was bearded, had, it would seem, been trying to light a paraffin lamp by means of a lighter on the gas stove when somehow all three became ignited. The stove was still burning, the paraffin lamp lay in a deeply pitted burned hole occupying the passage and the old man had stumbled across to fall into a couch. Autopsy showed he had inhaled soot particles: the blood HbCO was 52% and some vital changes showed in several large blistered burns of the legs.

In comparison with these accidents, direct homicidal burning is rare, but many cases are on record where hot metals, scalding water, and corrosive substances have been used with criminal intent.

A singular case occurred in which the mother of an idiot, wishing to get rid of him, poured melted pewter into his right ear while he was lying asleep. Great

[1] Dutra, F. R., 1949. *Amer. J. clin. Path.* 19, 599.

pain and violent inflammation followed, but the idiot recovered. The mother then alleged that he had himself poured the melted metal into his own ear.

In *R. v. King*, a woman was convicted of throwing boiling water over her husband, with intent to maim him. In *R. v. Blewitt*, the prisoner was convicted of the manslaughter of his wife by pouring over her the contents of a kettle of boiling water.

In *R. v. Hill*, the accused was convicted of feloniously casting boiling water over a man, with intent to do him grievous bodily harm. The medical evidence was that the scalds were on the head, cheek, neck, and arm, and were of a dangerous nature. A woman in Glasgow attempted to kill her husband by pouring boiling water over his genital organs while he was asleep in bed. He died, but his death could not be clearly attributed to the scalding.

An Irish labourer was tried for the murder of his infant daughter. The evidence showed that, in a drunken fury, the prisoner poured boiling water on the child. A jury found the prisoner guilty of manslaughter, and he was sentenced to three years' penal servitude. The judge said that if the prisoner had been in England he would have been convicted on the capital charge.

From time to time cases occur in the police courts in which a man in drunken fury pushes or throws his wife or child on the fire, and also cases in which lighted lamps are used as missiles.

Direct and deliberate attempts to burn a victim to death in the same sense that a murderer may stab, shoot, or strangle are rare.

A young man who had been strange in manner for some time stabbed his aging mother with a sheath knife some 17 times in the neck and chest. He then set fire to her, pouring petrol over her clothes and applying a match. The burns she had sustained were extensive high temperature scorchings with vital flushing and blistering: she was evidently still alive, though it was unnecessary to go into this aspect of the case since the house caught fire and the young man died. The blood HbCO in the mother was 17%.

Medical evidence may give rise to a suspicion of murder under two conditions: (1) when it is evident that several parts of the body have been burned at the same time, and the burns are not such as can readily be explained by the same accident (*vide R. v. Dobbin*[1]), or by an accidental ignition of the clothes (*vide R. v. Rouse*[2]); (2) when there are marks of homicidal violence on the body (*vide R. v. Furnace*[3]), (but such marks, if we except fractures of the bones, may be easily effaced when the burn is extensive). In investigating a suspicious case, we must remember that the fact of a dead body not being found near a fire or any substance capable of causing ignition does not necessarily justify an assumption of murder, since the deceased, unless disabled by intoxication, infirmity, or disease, may well be able to run away from the fire after an accident, and may be found dead at a distance without having been seen by any person.

The following cases are illustrative of some of the various points raised:—

Accident or Homicide. On the night of an alleged murder the prisoner was in bed, when his wife returned home with a lighted candle and some whisky, which she had procured from a neighbour. Some time after, a struggling was heard in the apartment, and when this had subsided a smell of fire was noticed. The neighbours endeavoured to obtain admission by knocking at the prisoner's door, but he either could not or would not hear them. At last a man forced his way in by breaking the window of the outer room. He found the room full of smoke and something burning in a corner, over which he instantly threw a pitcher of water; this proved to be the body of the deceased. Several persons then entered the inner room, where they found the prisoner either asleep or feigning to be so. On being aroused and told that his wife was dead, he expressed neither surprise nor sorrow, but coolly demanded by what

authority his neighbours had broken into his house, and threatened to send for a
constable. Some parts of the body were found completely carbonized by the action
of the fire, but on the face and extremities the fire had not acted with such violence,
and on these parts were found marks of vital reaction, indicating that the burning
had taken place during life. Some spots were merely red and inflamed, others scorched
to a hard transparent crust, but surrounded by a distinct redness; there were
also many vesications filled with serum. From these appearances the witnesses
gave it as their opinion that the deceased had been burnt to death. The jury, in
this case, returned a verdict of not proven, considering, no doubt, the possibility
that the deceased might have been accidentally burnt.

It is to be hoped that the following will remain a rare case:—

A man and a woman were charged with cruelty to a child aged seven years.
It was alleged that the woman was guilty of cruelty and that the man must have
been cognisant of it. An inspector of the National Society for the Prevention of
Cruelty to Children stated that the child had been burned in the hand with a flat
iron and on the soles of the feet with a poker. The magistrates described the case
as deplorable, and sentenced the woman to six months' and the man to three months'
imprisonment, each with hard labour.

The following criminal cases are worthy of note here:—

A girl of 16 was charged with manslaughter. She had come home late at night, and
her mother rebuked her—with a *sweeping brush*—for keeping late hours. The
daughter declared that if she was again struck she would kick over the paraffin
lamp, and on the blow being repeated she carried out her threat. A little brother,
six years of age, was close at hand; the lamp fell near him, set his clothes on fire,
and he was so seriously injured that he died. The indictment was thrown out by a
grand jury on the ground that there was no malice towards the victim.

In *R. v. Rouse,* (Northampton Assizes 1931)[1], the accused was charged with the
murder of an unknown man whose charred remains were found in a burnt-out motor
car at a village near Northampton, on November 6th, 1930. The car was destroyed,
and certain of the brass parts had been melted by the intense heat. The body
lay prone in the front compartment, with the face on the driver's seat. It was lying
with the right arm extended and lifted, burnt up to the elbow; the left arm was
not to be seen. Part of a pair of braces taken from the body, smelt strongly of petrol.
A dirty mallet was found near the car, with three human hairs adhering to it by
means of the dirt.

In the opinion of the medical witnesses there was evidence that the dead man
was alive in the blazing car a short time at least while the fire raged, and that he
continued to breathe for some time after the fire began.

In Sir B. Spilsbury's opinion, carbon monoxide had been produced in the course
of a fire, but had not been inhaled for long because it had not had time to get into
the blood in any appreciable amount. He thought that the victim must have died
within about half a minute after the fire started. The effect of the intense heat upon
the limbs would be to produce heat stiffening or heat rigor. Death had taken
place from shock due to burns. The fact that the skull had been splintered was
undoubtedly due to the heat. The prisoner was found guilty and sentenced to death.

and was not bruised: no doubt existed as to which was the entry and which the exit wound.

Death being almost instantaneous, the victim was dead when he was burned. The body was seated in the chair, and was partially covered with remains of clothing, but had been largely destroyed by fire. Part of a shirt bearing Spatchett's laundry mark, and the dental data, recognized by Spatchett's dentist, proved the identity of the victim.

TIME REQUIRED FOR THE BURNING.

It may be a medico-legal question whether, on discovering a body much burned, it could be determined from its appearance how long a period it would require to produce the amount of destruction observed. An answer to such a question may be necessary, in order to connect a person with the perpetration of an alleged crime, but the question does not admit of a precise answer. A conjecture only can be formed from the facts proved in each particular case. The human body contains a large proportion of water (72 per cent.); this gives to the soft structures a power of resisting combustion. At the same time there is a quantity of fat in the body, varying in different parts, but amounting to an average of about 5 per cent. The fat or oil tends to increase its combustibility, and this is still further increased if it is placed on any combustible article which can imbibe it, such as bedding or a deal floor. The nature of the clothing will also make a difference. Under an intense heat or flame, which might subsequently burn out before the discovery of the body, there would be a degree of destruction in half an hour which a more slow and smothered combustion would not effect in several hours.

This question actually arose in *R. v. Hatto.*

The victim was found dead in her room, her body much burned. She was last known to be living at about a quarter-past eight in the evening, and her body was found, still smouldering with fire, on the floor of the room, at about a quarter-past eleven. The only persons known to have been in the house were the prisoner and the deceased. The medical man who examined the deceased found that "both knees were consumed by fire, and the thighs, as well as the private parts, were burnt to a cinder, leaving the shafts of the thigh-bones exposed and charred for several inches. Between the thighs and the feet, the floor underneath-had been burnt away, and the leg bones had fallen through the floor, leaving the feet unburnt on the floor." He expressed an opinion that it would take from two and a half to three hours in order to consume the body to this degree, thus covering the whole interval during which deceased and prisoner were in the house together. The clothing of the deceased was much burned, and beneath the body there was a hempen mat which became highly combustible, owing to the melted human fat with which it was impregnated. The guilt of the prisoner was fully established from other circumstances.

It is obvious that an opinion on such a subject must be in all cases conjectural, since the effects, *cæteris paribus,* depend as much on the intensity as on the duration of the heat. It was indeed just as probable, medically speaking, that, with a more intense flame, the amount of burning met with might have been produced in an hour as in three hours. A confession by the prisoner, made subsequently, showed that the burning must have taken place in less than two hours, and perhaps within an hour and a half.

The case of the Countess of Goerlitz, too, is of more importance in this connection than as supporting the hypothesis of *spontaneous* combustion (*vide* below), which was seriously advanced. The confession shows its absurdity.

The trial took place at Darmstadt in 1850. A valet was charged with the murder of his mistress, who was found dead in her room; the clothing on the upper part of the body was almost wholly consumed; the head was a nearly shapeless black mass

in which the mouth was imperfectly distinguishable, with the charred tongue protruding from it. The skin and muscles of the face, neck and upper part of the chest was much blackened and charred. The joints of both arms were charred on their surfaces, and the blackened ends of the bones protruded. There were no marks of fire anywhere on the clothes beyond the margins of the burns on the body. A writing-desk near the body had been partially burnt, and the floor beneath and in front of the desk, over an area of a foot and a half, had been entirely consumed. The feet of a chair placed near the writing-desk were slightly charred. A folding-board and the drawers were also much burnt. It was proved that she had retired to her room between three and four o'clock in the afternoon, and that at seven there was no burning in the room. Between seven and nine p.m. a bright light was observed through the window, and smoke from the chimney. There is a little discrepancy as to the time, but taking the maximum, the amount of destruction described in this case must have occupied less than two hours, and probably not more than one hour. When the room was first broken into, and the countess was found dead, flames burst out simultaneously from the hangings, the writing-desk, and the floor beneath it, which required to be extinguished by water. The countess was thus found dead in her room on June 13th, 1847. The body was exhumed on August 11th, 1848, for purposes of inquiry. The Hessian Medical College, to which the case was referred, came to the conclusion that the countess had not died from spontaneous combustion.

The case was subsequently referred to Liebig and Bischoff; and their report was issued in March, 1850. They found no difficulty in concluding that the body had been wilfully burnt *after death* for the purpose of concealing murder. There was some doubt whether the deceased had died from strangulation, or from violence to the head. The valet subsequently confessed that the countess had entered her room as he was in the act of committing a robbery. A struggle took place; he seized her by the throat, strangled her, and afterwards placed the body in a chair, piling around it combustible articles of furniture. He set fire to these with the view of destroying the proofs of his crime. It will be observed that the tongue was found protruded, as it is in violent strangulation, and that in its charred state it retained the position given to it by the act of murder.[1]

Such cases prove that a short period may suffice for a large amount of destruction, and that, judging by what remains, the combustible materials consumed appear to bear only a small proportion to the parts of the body burnt. This may be accounted for by the large volume of flame produced during the combustion of articles of female clothing.

In car and plane accidents the intense heat of burning petrol may cause destruction of a great part of the body in a very short time.

Polson[2] states that, from information received from crematoria in England, the average time required for the complete incineration of an adult body, if enclosed in a coffin, is 80 minutes. The temperature of the incinerating chamber is usually 750°C.

GENERAL EXPOSURE TO HEAT—HEATSTROKE AND SUNSTROKE

The effect of an intensely hot atmosphere in causing death has been extensively studied since the writings of Boerhaave at Leyden in 1732. Experimental results in animals cannot be utilized directly to explain the effects of exposure to high degrees of heat in man, owing to the difference that exists between man and other animals in regard to the mechanisms of heat regulation.

[1] This observation has been rightly criticized in that intense heat or flame sufficient to dry and contract or destroy the skin of the face and to "pinch" the floor of the mouth tends to bare the tongue at the widened orifice of the mouth and to lift it in such a way as to make it *appear* to protrude. Other evidence of strangling would be far more secure (*vide* p. 491).

[2] Polson, C. J., Brittain, R. P., and Marshall, T. K., 1953. *The Disposal of the Dead.* London. English Universities Press.

Direct observations on man are more valuable, either under experimental conditions, or in the course of everyday life in the tropics, the arid desert or the engine rooms of steamers, or other places of employment characterized by high temperatures. There is no doubt that a healthy, robust man can become rapidly acclimatized to work in high temperatures without harmful effects, providing an adequate intake of fluid and salt is maintained. The acclimatization would appear to consist of an increased cardio-vascular efficiency with decreased production of heat, and also of increased loss of heat by sweating.

On the other hand, an attempt to work under similar conditions may prove disastrous to the individual who is not acclimatized, or who is rendered susceptible by the presence of any of the known pre-disposing factors, which include alcoholism, fatigue, active disease, especially of a dehydrating nature, or a heat regulating mechanism already disturbed by recent fever.

Apart from the temperature of the atmosphere, the most important external factor is the degree of saturation of the atmosphere with moisture; an increase in the atmospheric humidity may produce heat effects even in those apparently acclimatized.

Heat-exhaustion is the most accurate term applied to syncopal attacks or prostration due to excessive heat. Such attacks are seldom serious, being largely vasomotor in substance.[1]

Heat-pyrexia, or sunstroke, is characterized by collapse, sometimes with immediate unconsciousness and death. In other cases, progressive mental confusion and delirium may gradually deepen into coma. Convulsions may occur. The face is congested, and the skin is dry and hot. The temperature is high, from 105° or 106°F. up to 110°F., or even higher as the case progresses to a fatal issue. Clinically, the case may resemble meningitis, but the cerebro-spinal fluid is usually normal in appearance and rarely under raised pressure.

More commonly, however, there is a preceding apyrexial period of headache and lassitude, giddiness and nausea, insomnia, and mental dullness or irritability. If these symptoms are recognized, appropriate measures may prevent the development of a serious or even fatal attack of acute heatstroke.

The *post-mortem* findings in fatal cases of heat-exhaustion are by no means pathognomonic. Marked venous congestion of the viscera is usual. Pulmonary œdema, often hæmorrhagic, and multiple small hæmorrhages of anoxic type are other findings frequently made. Search should be made for the presence of such small hæmorrhages in the brain, but the mechanism responsible cannot be regarded as fully understood.

Heat-cramps (miner's cramps, stoker's cramps), frequently occurring in the engine-rooms of ships in the tropics, are due to excessive loss of chlorides by sweating. The muscle cramps are accompanied by headache, dizziness, and vomiting, and occasionally the condition may complicate the picture of serious heatstroke. Treatment and prevention both consist of maintaining the intake of fluids and chlorides. By examination of the urine, a valuable indication of the body's chloride content can be obtained. Elimination of less than 3·0 grammes of chloride in the urine passed during the 24 hours is stated to indicate a dangerous depletion of chloride in the body. The mortality is negligible.

[1] Talbot, J. H., 1944. In Medical Physics. Ed. O. Glasser. Chicago. The Year Book Publishers, Inc.

Medico-legal Relations of Heatstroke. Cases have come before the courts in which heatstroke has figured in claims, by workmen for compensation. The reader is referred to text books on compensation for details of such cases.

SPONTANEOUS COMBUSTION

It is nearly a century and a half since the hypothesis of the spontaneous combustion of the human body took its origin, and though the claim is so opposed to any known facts in connection with the human body, we may mention it as a historical matter. Chemists are aware of a few circumstances under which ignition does spontaneously arise from the juxtaposition of two bodies (pure potassium and water, for example), neither of which need be even warm; but assuredly no such bodies have ever been found, nor ever arise, *in the human body in ordinary conditions nor in any conditions known to science.*

While thus absolutely rejecting any doctrine of spontaneous combustion, it must be admitted, on the other hand, that there are cases recorded by credible authorities which require some explanation to account for the unusual amount of destruction (burning) which has been produced in a human body by what are at first sight very inadequate means; a doctrine has hence arisen that in certain circumstances the body does acquire properties of *preternatural combustibility.* This is, of course an entirely different matter.

In all such cases, a candle, fire, or some ignited body has been at hand, and the accidental kindling of the clothes of the deceased has been at least a possibility, if not a probability, and no further explanation has been required of the *origin* of the fire; but the amounts of destruction of the body compared with that of surrounding objects has certainly in some cases been remarkable. Before attempting any explanation we may quote a few illustrative cases:—

Ogston, sen. and jun.,[1] related the two following cases of "preternatural combustibility" which came within their own experience. *A woman, aged 60, of intemperate habits, was left in her house alone.* An hour later her body was found on the third step of the stair near the kitchen; the step on which the corpse rested, and one of the spokes of the wooden hand-rail was charred, as were the seat of a chair and a small portion of the front of a straw mattress on a bed, both of which were in a kitchen on the same floor and adjoining the staircase. Contrasted with this moderate amount of combustion in the vicinity of the body was the extent of its effects on herself. On the front of the head and face the absence of the soft parts left the exposed bones blackened and calcined. On the back of the neck and chest patches of a greasy charcoal were found here and there, and in addition, the spinal column and several of the ribs were exposed and much charred. The abdominal wall was wanting, the intestines a burned and blackened mass, and the surface of the liver calcined. The upper limbs were distorted, the elbows strongly flexed, and everywhere charred to a great depth; the bones, however, even of the fingers, preserving their position. The right thigh had its deeper muscles still uncharred, but presenting the appearance of roast beef, and was very dry. The skin and superficial muscles were completely burnt away. The right leg, only partially attached to the thigh, was entirely converted into a greasy black charred mass, even the bones not escaping. The right foot, totally detached from the leg, had been changed into a soft, black, greasy, and shapeless cinder. The left thigh, leg, and foot were in a condition similar to the right. Not a vestige of clothing remained anywhere.

In the second case a woman, aged 60, was left by her husband in bed apparently in her usual health. Three hours later smoke was noticed issuing from the room, and the woman was found dead close to the fireplace, in which there were then only a few nearly extinguished embers; her nightdress, her only clothing, was on fire. It was supposed that two hours previously, and an hour after her husband had left

[1] Ogston, F., 1879. "Lect. on Med. Jurispr"., pp. 463, 559.

her, the *deceased had got out of bed to light the fire in her room*. The whole of the right side of the body was more or less burned, the burns being in all stages, from mere reddening of the skin to its complete destruction, along with that of the flesh underneath it. The flesh of the right arm was charred down to the bones, and the elbow joint was laid open. The superficial muscles of the right thigh were burned away, and the deeper muscles roasted. The right side of the face and head were charred. The right breast was roasted. There were burns of the first and second degrees on the left arm and hand.

Careful search by fire officers such as is conducted nowadays would seem likely to have thrown some light on the source of both of these fires.

In both cases the combustion appears to have originated from the ashes in the fireplaces, but, in the opinion of Ogston, they seemed insufficient to account for the extreme destruction of the bodies without supposing that they were in a state of unusual readiness to support combustion. Truth is stranger than fiction, and remarkable, even "selective" destruction of an occasional burned body need not excite suspicion of something preternatural.

The following case occurred in France:—

The body of a man was found lying in bed, and in a state of combustion. The room was filled with a dense smoke, and one of the witnesses asserted that he saw a small whitish flame playing around the body of the deceased, which receded from him as he approached. The clothes of the deceased and the coverings of the bed were not entirely consumed, and *the wood was only partially burnt*.[1] There were no ashes, and there was but a small quantity of vegetable charcoal; there was, however, a kind of mixed residue, altered by fire, and some pieces of animal charcoal, which had evidently been derived from the joints. The deceased was in the habit of carrying lucifer-matches in his waistcoat pocket; and, according to his usual practice, he had had a hot brick placed at his feet when he went to bed the preceding evening. Two hours afterwards his son and daughter-in-law passed by the door of his room, but there was nothing which attracted their attention. The deceased was 71 years of age. He was not fat, nor was he addicted to drunkenness. The temperature of the air was low; and there were no electrical manifestations. The son and his wife were suspected of having murdered the deceased, and of burning the body in order to conceal the traces of the crime. The body, which had been buried, was exhumed and examined. The partially burnt cravat was still around the neck, and part of a sleeve of a nightshirt was found. The hands, completely burnt, were also attached to the forearms by some carbonized tendons, which gave way on the slightest touch. The thighs were detached, so as to resemble a wilful mutilation but for the discovery of animal charcoal about them. From these facts, Masson considered it impossible to ascribe the changes to the effect of accidental burning; and as they could only be produced by combustion continuing for some time, he drew the inference that the burning must have resulted from some inherent cause in the person, probably roused into activity by the hot brick placed at the feet of the deceased.

The burning once commenced, would be easily supported by the state of the tissues. Hence the case was, in his opinion, to be referred to the class of spontaneous combustions. Orfila is reported to have agreed with Masson in this opinion, and the accused were acquitted.

Accidents among the elderly lying in bed with nightlights and candles or smoking are so common—and so commonly involve the hands and thighs or the lap—that such an explanation would seem more likely.

The complete destruction of the clothes by burning in some of the quoted cases shows that the fire was *ab extra* while the localization of the burns to the body, the absence of singeing of the hair, the quantity of carbon particles about the body and other circumstances suggest the probability that a highly inflammable liquid had been used to saturate the clothes. It is very difficult to imagine how such a case could have occurred from accidental causes.

[1] This might well account for a flicker of flame "playing around the body of the deceased".

What, then, can be offered as the explanation of such striking combustibility of the body? The following points may be considered:—

(a) Experiments.
(b) Influence of alcohol.
(c) Influences of gases in the living.
(d) Influence of gas formed after death.
(e) Influence of fat.

(a) **Experiments.** Taylor, in early editions of this work, stated: "Dry animal solids readily burn, but the soft parts either in the living or recently dead body, contain as much as 72 per cent of water, which renders them highly incombustible. Until a large proportion of this water is evaporated, the substance does not undergo combustion. In many experiments made on different organs and on different bodies, the author has not observed that different parts of the same body or the parts of different bodies have varied in their degree of combustibility. The bones alone have withstood a greater degree of heat, from the large proportion of earthy matter contained in them. The experiments have led to this result—the flesh and the organs generally are very difficult of combustion, and can be completely consumed only in a strong fire and under a powerful current of air. Experiments on the bodies of animals have shown that they possess the same property of difficult combustibility. The presence of alcohol in flesh does not render it combustible. The alcohol will burn, but the flesh can only be burned by removing from it the substance which interferes with its combustibility—namely, water. Tissues which have undergone extensive fatty degeneration may, nevertheless, become unusually combustible, so as to burn readily on the application of the moderate heat of a spirit lamp".

(b) **Influence of Alcohol.** While it is generally observed that the bodies which seem to be unusually combustible are those of persons who, during life, were much addicted to alcohol, and had become very fat, and that the fatal accident generally happens when the victim is very drunk, it is quite certain that the alcohol plays no direct part in combustion. Alcohol absorbed by a person in quantities sufficient to cause death could not possibly have the slightest effect on combustion.

(c) **Influence of Gases in the Living.** A case is recorded in which a man set fire to his breath in blowing out a match; and another case in which the gas issuing from some vomit was set on fire. We thus have proof that, even during life, gases may be present in the stomach which are capable of igniting on the application of a flame; whether such might also continue to be formed after death is exceedingly doubtful.

(d) **Influence of Gases formed after Death.** Some bacteria have the property of evolving gases which are inflammable. The ignition of such gases might cause a certain amount of destruction of the tissues and clothing.

(e) **Influence of Fat.** It has already been noted that the bodies which are unusually combustible are usually fat. Fat burns readily when once it is ignited, and it is possible that the clothing and the fat of the body may act as the wick and the tallow in a candle respectively.

Medico-legal Aspects of Unusual Combustibility

In this connection the admission of the existence of unusual combustibility may be very important, for it may be made the basis of a defence in certain

cases. It frequently happens that the skin is much injured by fire, while the muscles and soft parts beneath have suffered but little. There are some circumstances which may occasionally explain the varying extent to which parts of a body are found burnt. An assassin may have employed petrol, benzine, paraffin, methylated spirit, turpentine, or other inflammable liquid, of which no trace may be found; and the great destruction of the body may, therefore, be due to this extraneous cause, and not to any increased combustibility of its parts. A short exposure to a large volume of flame, owing to its high temperature, will speedily char the flesh and consume it. Articles of female dress, from the quantity of air enclosed between the layers, are capable of producing a considerable volume of flame, and thus the bodies of women are sometimes extensively destroyed, as a result of the accidental burning of the clothes. Even allowing that parts of the human body might, in certain cases, acquire increased combustibility, burning of a body cannot possibly take place except by contact with some substance already in a state of combustion. But whether the ignition of the clothing of a deceased person took place accidentally, or by the criminal act of another, is a totally different question: it can be cleared up only by circumstantial evidence.

A defence of spontaneous combustion, if admitted, might prove most convenient to assassins. Taylor pointed out that the case of Mrs. Pulley, whose body was examined in 1860, the circumstances were such as to require little ingenuity to transform them into a *prima facie* case of spontaneous combustion, although a proper inquiry showed that it was a deliberate murder by strangulation. There was a subsequent burning of the body by means of the clothing, in order to efface the signs of violent death.

The deceased was found lying on the hearth of her room, about three or four feet from the grate. From the shoulders downwards the body was lying on a boarded floor of oak. The deceased was fully dressed, and parts of her clothing and body had been destroyed by fire. A brass candlestick was lying between the left arm and the body, the top of the candlestick being inclined towards it. The clothes were wholly burnt off both arms, and partly off the upper portion of the trunk. The legs were not at all burnt. A bonnet which the deceased wore was partly burnt. The right arm was elevated by the side, with the elbow resting on the floor. The fingers were partly burnt off, and the remainder of the hand was charred. The left hand, which was stretched out, was not so much burnt as the right. Some ashes from the clothing lay between the left arm and the body. The burning had ceased, but there was a strong smell of burning in the room. There had been no fire in the grate. Under the body there was a hole in the oak floor, which had been produced by burning. The features were distorted and swollen, and the eyes suffused with blood. Some parts were burnt to a cinder, whilst others were but little affected by the fire.

BURNS FROM X-RAYS

Over-exposure to X-rays may produce damage to the tissues of varying degrees of intensity depending on the strength of the dose, the period of exposure and the type of tissue irradiated. When over-exposure is slight, the skin becomes inflamed and reddened, but after a short period, this passes away, leaving only a slight bronzing. When there is a higher degree of over-exposure the skin may blister and there may be atrophy of the superficial tissues and obliteration of the superficial blood vessels. As a result the tissues become very susceptible to slight degrees of trauma, and if the skin should break down the ulceration is extremely difficult to heal.

When the over-exposure has been severe, deep ulceration of the tissues may result. These ulcers are most intractable, may resist all forms of

treatment and may ultimately lead to the development of malignant disease in the damaged area.

Late Reactions.—In rare cases the patient may exhibit no signs of over-exposure after irradiation, but may develop a peculiar condition a considerable time afterwards; a bluish discoloration may appear below the skin, due apparently to some deeper damage, and gradually approach the surface when considerable sloughing of the tissues may occur.

The reason for these late reactions is not known, but they do not appear to be due to ordinary over-dosage, and there appears to be no means yet known of guarding against them.

VITRIOL THROWING

This crime, which still occurs occasionally, demands brief attention:—

Section 29 of the Offences against the Person Act, 1861, provides as follows:—

"Whosoever shall unlawfully and maliciously . . . put or lay at any place, or cast or throw at or upon or otherwise apply to any person, any corrosive fluid or any destructive or explosive substance with intent . . . to burn, maim, disfigure, or disable any person, or to do some grievous bodily harm to any person, sha l, whether any bodily injury be effected or not, be guilty of felony . . ."

The nature of the liquid thrown is merely defined, in general terms, to be "any corrosive fluid or any destructive substance"—a point which will *require chemical evidence for its elucidation.*

In common language, and according to the statute, the injury thus produced by a mineral acid such as oil of vitriol is called a burn: but it is, in fact, an acid corrosion.

The injuries from a corrosive fluid may be very severe, the severity depending partly on the nature of the fluid and partly on the time that it is in contact with the tissues. Great deformity from scarring has resulted, and of course if some of the fluid reaches the eye, blindness may easily ensue.

Although sulphuric acid is most commonly used, both nitric and hydrochloric acid have also been thrown at the person with malicious intent. The caustic alkalies may also be used in these circumstances, as well as numerous other liquids, on which the only medical opinion required would be whether the article employed should or should not be considered as a "corrosive fluid" or a "destructive substance". Unless vital reaction has taken place, there are no means of distinguishing the effects of a corrosive liquid on the living from those produced on the dead body. In either case a brownish, parchment-like condition will be produced by drying of the tissues underneath the epidermis, or frank acid corrosion may occur.

To constitute a felony, it is not necessary that the *person* should have sustained any bodily injury from the act of throwing; but in such cases proof of the corrosive nature of the liquid is required, and this is easily obtained by a chemical examination of a part of the clothing. In *R.* v. *Goff,* the injury appears to have been of a superficial kind. The jury found the prisoner guilty of throwing the corrosive fluid, but with no intent to injure. This was tantamount to an acquittal. Damage to the clothing only does not constitute the crime. There must be an intent to injure the person.

When some corrosive has been thrown at a person and has reached either the skin or clothing, chemical evidence of the nature of the liquid thrown is of very great importance. The colour of the injured part may help. Thus sulphuric acid has a tendency to char tissues, and so may leave a dark or

even black mark; nitric acid produces yellow stains on the clothing, and hydrochloric stains it whitish or grey. On the clothing, nitric acid frequently makes a yellowish red stain, whereas sulphuric usually causes destruction of the material. Caustic alkalies produce a soapy feel on either skin or clothing. If enough of the fluid still remains on the skin or clothing to admit of extraction and analysis, such should be made, but naturally this is rarely the case, as efforts are usually at once made to get rid of the fluid. It is very rare for the affected part of skin to be hard, as in a burn from flame; it is usually soft and necrosed.

The mineral acids are sometimes used in other ways for the destruction of life.

A man poured a quantity of strong nitric acid into the ear of his wife while she was lying asleep. She awoke suddenly with a violent pain in the ear, which continued for three days; she became weak and exhausted. Soon afterwards there was copious bleeding, and a portion of membrane was extruded. She lost the use of her right arm, and became completely deaf. Suppuration took place from the left ear, and the blood escaped daily. She gradually sank, and died six weeks later. A part of the external ear was wanting, and the ear passage, was much wider than natural. The brain near the petrous portion of the temporal bone was softened, and the bone itself soft and necrotic. The injury had caused death indirectly by producing disease of the brain.

In a case at Aberdeen, a woman poured oil of vitriol down the throat of her husband while he was asleep with his mouth open. She was convicted of murder. In *R.* v. *Lipski*,[1] a murder was committed by pouring a mixture of nitric and sulphuric acids down the throat of a woman in bed.

These, however, were treated as cases of poisoning, as death did not depend on the local or *external* damage produced by the corrosive agent employed.

A remarkable case of assault was heard by the Eastbourne magistrates in 1904. The complainant was Henry Andrews, and the defendant, Mrs. Pansy Pringle. It appeared that Andrews had complained of Mrs. Pringle to her husband. The parties met and discussed the matter. A lively altercation ensued, in which it was alleged that Mrs. Pringle attempted to stab Andrews in the face with a hatpin. Mrs. Pringle called Andrews a liar and a thief, and then suddenly threw the contents of a glass in his face, at the same time saying, "You will not see daylight again." Andrews' face began to blister, and he was unable to open his left eye, but under medical care he recovered. The stuff thrown was in fact a mixture of Condy's fluid and pepper. Mrs. Pringle said that her only object was to frighten Andrews. She was ordered to pay an inclusive penalty of £4 10s.

The material thus used would certainly cause great suffering, and must be considered frankly "corrosive".

CHAPTER XIV

STARVATION

STARVATION is commonly associated in everyday medico-legal practice with neglect, but we propose to concern ourselves herewith the effects of the mere deprivations of food as seen in:

(a) Accidental entombment —in pits or mines, landslides, etc.

(b) The deliberate witholding of—or refusal to take—food.

(c) Concentration camp conditions.

(d) Famine.

The subject will be briefly discussed under the following headings:—

Medico-legal Aspects of Starvation—Its Frequency as a Cause of Death—The Symptoms—The Treatment—The *Post-mortem* Appearances—Was Death due to Starvation?—Baby Farming—Voluntary and Pretended Starvation.

Medico-legal Aspects of Starvation

Starvation is generally the result of accident or homicide, but this is purely a question of fact and can seldom be elucidated by medical evidence. Wilful deprivation of food for an infant or any other helpless person which results in their death may amount to murder, if such non-provision is wilful and malicious, or to manslaughter if such non-provision is due to reckless negligence. The case of *R. v. Staunton and Rhodes* (unreported) is an example of a conviction of murder for starving a woman to death. The case of *R. v. Chattaway* (*vide infra*) is an example of a conviction for manslaughter for causing the death of a woman by starvation and neglect. The Children and Young Persons Act of 1933 provides legal protection for children and young persons and (*inter alia*) makes it an offence for persons having their custody not to provide them with sufficient food.

In *R. v. Staunton and Rhodes*, a man named Staunton, his mistress, Alice Rhodes, his brother, and his brother's wife, were tried and convicted of the murder of Harriet Staunton, the wife of the first-named prisoner.

Harriet Staunton was a woman, aged 40–50, of weak intellect; her husband had become on intimate terms with Alice Rhodes. The deceased and the prisoners all lived together in a small house in the country. She appears to have been submitted to a systematic course of cruelty and neglect; and, as was alleged, this was carried to the extent of starving the woman to death.

The circumstances of the case and the mode of her death, (coma, rigidity of one arm, and unequal pupils), giving rise to suspicion, an inquest was held, and an inspection made. The following is a summary of the appearances observed after death:—The body was emaciated and very dirty; lice and eggs of lice and bugs were in the hair; the skin, like parchment, was drawn tightly over the face; the breasts and abdomen were shrunken. The brain was healthy, with the exception of a small recent patch of tuberculosis of the meninges. The heart was small, empty, and healthy. The lungs were healthy, with the exception of about an inch and a half at the upper part of the left lung, which was the seat of inactive tuberculosis. There was no disease or inflammation of the peritoneum. The gall-bladder was full. The stomach had some undigested food in it, consisting of milk and chopped

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or chewed eggs, which was distinctly visible through the thinned coats of the stomach. The intestines were collapsed, shrivelled, and completely empty. There was a total absence of fat from all parts of the body. All the organs were considerably below the normal weight. No poison was found in the body.

At the trial, positive statements were made that the cause of the woman's death was starvation. On the basis of these opinions, the judge summed up the case in a manner which led to a conviction. The case created great interest; and subsequently to the trial several eminent medical men came forward and gave emphatic expression to opinions that there was no medical proof that the death of the deceased had been caused by wilful starvation. The cross-examination of the medical witnesses for the prosecution elicited the fact that there were miliary tubercles in the brain. Alice Rhodes eventually received a free pardon, it being difficult to hold her legally responsible, and the other three prisoners had their death sentence commuted.

In *R. v. Chattaway*,[1] a man and his wife were convicted of the manslaughter of their daughter, aged 25. The cause of death was neglect and starvation.

Its Frequency as a Cause of Death

Taylor, in the previous editions of this work said: "Death from the mere privation of food is a rare event, although, if we were to form an opinion from the verdicts of coroners' juries, its occurrence would not appear to be uncommon in London and other large cities. Still it cannot be denied that starvation should be classed among the forms of violent death, sometimes the result of criminal neglect or inattention in the treatment of children or of infirm and decrepit persons, and thus constituting homicide; or at other times, although rarely, arising from an obstinate determination to commit suicide in those from whom all other means of self-destruction are cut off".

These remarks may be considered as still applicable to the present day experience in any large city. War, and the famines which stalk the world with it, introduce new aspects of starvation with which we are not concerned in a work of this kind.

Symptoms of Starvation

The symptoms which attend on protracted lack of food (*chronic starvation*) have been widely described.[2] In the first instance, hunger pain is felt in the stomach, which is relieved by pressure. The countenance becomes pale and cadaverous; apathy is pronounced and fatigue easy; the mouth is dry and parched, the saliva thick and sparingly secreted; an intolerable thirst supervenes, which in all cases of attempted suicide by starvation or privation of food from accident has formed a most prominent symptom. The body is hypothermic and becomes slowly emaciated,[3] the eyes and cheeks sink, and the bony prominences become perceptible; oedema may or may not occur, and pain may be so intense as to give rise to delirium. There is the most complete prostration of strength, which renders a person incapable of the least exertion, and liable to inter-current infection. Death may be preceded by delirium or convulsions.

Leyton was himself a prisoner of war, suffering from the effects of protracted food shortage, though adequately protected against the cold. Conditions were not

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[1] (1922), 17, Cr. App. 7.

[2] See *Modern Trends in Forensic Medicine*. 1953, 124. Keith Simpson. London: Butterworth & Co.

[3] Mollison, at Belsen, found a loss of as much as 34·8% of the original body weight.

so severe as in the concentration camps or the severely restricted "B.2" district of Holland, but they were sufficiently bad to cause, among those ineligible for additional Red Cross food, all the symptoms and signs of slow starvation. Outstanding symptoms were: loss of well being, hunger and hunger-pains, progressive mental and physical lethargy, sleepiness and easy fatigue—progressing to exhaustion. Prominent physical signs were: loss of muscular power and of weight, progressing to emaciation, increased urinary output, sallow skin, mild anæmia and a variable degree of "hunger-œdema." Hypothermia, hypotension, sluggish reflexes and mentality, together with some visual disturbance accompanied these changes.[1]

Donovan recorded how the persons who suffered from privation of food during the Irish famine of 1847, described the pain of hunger as at first very acute, but after 24 hours had passed without food, the pain subsided, and was succeeded by a feeling of weakness and sinking, experienced principally in the region of the stomach, accompanied with insatiable thirst, a strong desire for cold water, and a distressing feeling of coldness over the entire surface of the body. In a short time the face and limbs became frightfully emaciated; the eyes acquired a peculiarly wild stare; the skin exhaled an offensive smell, and was covered with a brownish filthy looking coating, almost as indelible as varnish. This he was at first inclined to regard as encrusted filth; but further experience convinced him that it was a *secretion poured out from the surface of the body.* The sufferer tottered in, walking like a drunken man; his voice was weak, like that of a person affected with cholera, he whined like a child, and burst into tears on the slightest occasion. In respect to the mental faculties, the prostration kept pace with the general wreck of bodily power. In many there was a state of imbecility, in some almost complete idiocy.

In the last stage the body is reduced to an extreme state of emaciation, and before death it evolves an offensive odour, like that of incipient putrefaction. The excretions have also a putrescent odour. The surface of the skin may be covered with spots (petechiæ); and the person finally dies, of inanition, circulatory failure due to brown atrophy of the heart, or intercurrent infection.

A healthy man of 65, was by an accident shut up in a coal-mine for 23 days without food. When found he was conscious, and recognised and named his deliverers. He was so weak that he could scarcely raise his hand to his mouth, and so much emaciated as to excite the surprise of his fellow-workmen by the extreme lightness of his body. Under careful treatment he so far recovered as to give an account of his feelings. For the first two days hunger had been his most urgent symptom. This passed off, and he then began to suffer from severe thirst, which he allayed by drinking some foul water. After ten days he became so weak that he was unable to move from the spot where he had laid down. He slept but little, and not soundly, never entirely losing the consciousness of his situation. His bowels acted only once, but he passed urine freely. The matter brought from his bowels by injections was dark-coloured, like mæconium, and very fœtid. He died on the third day after his removal, in spite of every effort to save him.[2]

The shocking conditions that developed in the German "concentration camps" like Belsen, the privations suffered by the Dutch in 1944–5 immediately prior to the collapse of the occupying forces' administration, and the recurring famines in Greece in 1941 and 1943 have made the wretched sufferings of starvation almost commonplace. They were made the subject of a number of studies by well organized nutritional survey groups of which the studies by Keys[3] and the account of the Oxford Nutrition Survey team[4] may be read with much profit.

It has always been evident that inter-current infection among those suffering from starvation is as grave a menace to life as any other cause. In a

[1] Leyton, G. B., 1946. *Lancet*, 2, 73.
[2] *Lond. Med. Gaz.*, 1835-6 vol. 17, p. 285.
[3] Keys, A., *et al.*, 1950. The Biology of Human Starvation, vols. I and II. Minneapolis: Univ. of Minnesota Press.
[4] Malnutrition and Starvation in the Western Netherlands. 1948. The Hague General Slate Printing Office.

population as healthy as that of Holland, Banning, the Chief Medical Officer of Public Health, pointed out the steep rise, during the period of acute food shortage, of the incidence of diphtheria, typhoid fever, dysentery and tuberculosis.[1]

In 1939 the deaths from diphtheria in Holland were 75; in 1943, 2515. The same years' figures for typhoid were 25 and 76. Tuberculosis showed in 1943 an increase of 70.5% over the 1939 figure. The first cases of death from hunger were registered in January 1945, and, owing to a virtually complete collapse of food distribution, increased alarmingly each week, 15,000 dying in the worst area (B.2) alone. The calorie value of the ration had, in a few weeks dropped from 1300 to 250 per day.

The very young and the aged suffer the worst from such depredations, and, as might be expected in mass famines, the death rate in women is significantly lower than that in men.

The period which is required for an individual to perish from hunger is subject to variation; it will depend materially upon the fact whether a person has had it in his power or not to take liquid at intervals to relieve the overpowering thirst which is commonly experienced. The smallest portion of liquid thus taken occasionally is found to be capable of prolonging life. It is probable that in a healthy person under perfect abstinence, death would not take place in a shorter period than a week or ten days. This opinion derives support from the results of those cases in which there has been abstinence owing to disease in the throat and difficulty in swallowing food. Age, sex, state of health, and the effects of exposure to cold may bear significantly on a fatal termination.

In a bombing attack on Clydebank on March 15th, 1941, two men were entombed for seven and a half days without food or drink in a cold, damp atmosphere. Both survived.

In Belsen, ultimately the worst concentration camp of all, only those able to help themselves to "food" managed to get anything during the last fortnight. They ate half a litre of mangel-wurzel soup per day. Approximately 10,000 unburied dead lay in the camp on the day the British troops arrived: intercurrent diseases such as parotitis, typhus, dysentery, pulmonary tuberculosis were taking toll of about 700 persons each day.

Within very recent times, the famine in Bengal[2] and the liberation of prisoners' camps in Germany,[3] Japan, and Malaya have made the clinical picture of starvation familiar to many observers. The extreme degree of emaciation and weakness found still compatible with life, has proved astonishing. A terminal, non-infective, diarrhœa has been common, and a similar condition has resulted from injudicious feeding after liberation. Medical men, who were themselves interned, have expressed the conviction that a famine œdema occurs only as a result of prolonged semi-starvation, seldom, if ever, in the course of what may be termed acute starvation. Where large numbers of starving or badly undernourished men have been aggregated in bad living conditions, super-added diseases have naturally been rife (*vide supra*).

Rest, warmth, and a very gradual increase in the amount of food, with balanced vitamins, is the appropriate treatment. Even in cases of only moderate severity it is advisable to commence with small liquid feeds.

[1] Banning, C., 1947. *Brit. med. J.*, 1, 539.
[2] Aich, L. R. C., Chakravorty, M., and Chandra, S. C., 1944. *Calcutta med. J.*, 41, 277.
[3] Oxford Nutrition Survey, 1947. Sinclair, H. M. (Enseignements de la Guerre, 1939–45. Nutrition). Liège: Masson & Cie.

Loss of tissue protein is a serious factor in starvation, and, in particular, protein is required for the regeneration of the intestinal epithelium. From the start of treatment, therefore, a protein intake must be ensured, and this must be covered by sufficient glucose to prevent its being diverted for production of energy. A diet of skimmed milk proved successful in the aftermath of the second world war.

Post-mortem Appearances

The body is shrunken and emaciated, and may reach 38 per cent of the initial body weight.[1] The skin is dry, shrivelled, pigmented and free from fat. The muscles are darker, deprived of fat, and much reduced in size. The stomach and intestines are usually found collapsed, contracted, and empty, the mucous membrane being remarkably thinned and sometimes ulcerated; the heart, small from brown atrophy, and kidneys free from any surrounding fat; the gall-bladder distended with bile; the omentum shrunken and destitute of fat. The skeleton becomes demineralized.[2]

FIG. 49. Conditions of partial starvation complicated by neglect in a woman of 77 found dead at home after 7 weeks refusal to admit a doctor or other skilled assistance. It was said that deceased had not undressed for 2 years.

Donovan states that the appearances which he witnessed during the Irish famine were extreme emaciation, total absorption of the fatty matter beneath the skin of the body, total disappearance of the omentum, and a peculiarly thin condition of the small intestines, which were so transparent that, if the deceased had taken any food immediately before death, the contents could be seen through the coats of the bowel. On one occasion he was able to recognise a portion of raw green cabbage in the duodenum of a man who had died of starvation. The thin condition of the coats of the intestines he looked upon as the strongest proof of starvation.

These appearances, in order to establish their significance in relation to death, should be *accompanied by an otherwise healthy state of the body,* since, as is well known, they may be produced by many organic diseases; death may be thus due to disease, and not to the mere privation of food. It will not be always easy to say whether the emaciation depends on disease or want of food, unless we are put in possession of a complete history of the case. On this account, in all charges of homicidal starvation, the defence

[1] Mollison, P. L., 1946. *Brit. med. J.,* 1, 4.
[2] Barger, G. E. C., et al., 1951. *Lancet,* 2, 282.

generally turns upon the co-existence of disease in the body, and the sufficiency of this to account for death.

Stevenson believed that the only diagnostic signs of starvation were emaciation, absence of fat from the body, distention of the gall-bladder, and a peculiar thinning of the walls of the intestinal canal, which may become extremely translucent. A full gall-bladder is, however, of frequent occurrence in death from many causes, and indicates nothing more than the non-passage of food over the orifice for some hours preceding death.

Was Death due to Starvation?

If in an autopsy we find the general conditions of inanition, and especially the absence of fat, we are justified in saying, in the absence of any disease, that death was at least accelerated, if not actually caused, by (a) an absence of sufficient food to maintain life, or (b) inability to utilise and absorb the food that had been given. If disease is found as well as these signs of starvation

Fig. 50. *Gross neglect of a child of 7 months left at home without care or attention for a period approaching 2 months. Napkin area soreness has developed into deep excoriations spreading down the backs of the legs and over the trunk.*

the problem is more complicated, for it is only in certain special cases (stricture of œsophagus or pylorus, for example) that we are able positively to ascribe the wasting to the *mechanical* effects of disease. In the majority of cases it is impossible to disentangle the *physiological or pathological* possibilities of the disease from the effects of alleged starvation and neglect.

The difficulties connected with medical evidence of death from starvation were well illustrated in *R. v. Mitchell.*[1]

[1] Oxford Lent Ass., 1861.

The accused was charged with the manslaughter of his servant, a woman, aged 24, by withholding from her sufficient food. The evidence failed to support this charge, although there could be no doubt that deceased had died either from an insufficient supply of food or from the fact that the food which she had taken, or had it in her power to take, was not adequate to support life. A medical witness for the prosecution, who saw the deceased for the first time on January 4th, found the woman feeble, emaciated, and suffering from exhaustion; she complained of great weakness and giddiness. There was no natural disease to which these symptoms could be referred. In spite of her removal and the use of stimulants, she died in five days. On inspection there were no appearances to account for death from natural causes. The body was much emaciated, and so light that it weighed only 50 lbs; and there was no fat. The intestines were thin and transparent in parts; the stomach and small intestines were much contracted. There was an entire absence of fat from the omentum and mesentery; the gall-bladder was much distended with bile. The other organs of the body were healthy, and there was no disease in any part to account for the emaciation. Two other medical witnesses confirmed this evidence at the trial, and they all agreed that the appearances were consistent either with death from starvation or insufficiency of food or with the non-assimilation of food. It was suggested in defence that deceased might have died from chronic diarrhœa; but there was no proof that this had existed to a degree to account for death, and during the last five days of her life it was proved that she did not suffer from diarrhœa at all. A statement made by the deceased went to show that food had not been withheld from her, and the accused was acquitted.

The cause of death and the guilt of the accused were, however, separate questions. There is no reason to doubt that the opinion given by the three medical witnesses was perfectly correct, and justified by the facts which they had observed. The symptoms and appearances, as well as the entire absence of any natural disease to account for them, lead to the conclusion that the deceased could not have taken sufficient food to support life, or that which she took was not properly assimilated; and in either case the symptoms and appearances would be those of death from protracted abstinence or starvation. As she was of weak constitution, and the weather at the time she was first seen had been remarkably cold, it is probable that these indirect causes aggravated in some degree the effects of insufficient nutriment.

It must not be forgotten that any death from inter-current infection such as dysentery, typhoid or tuberculosis, though it might be felt due indirectly to the state of inanition and reduced resistance, must offer a complex problem for opinion. It cannot be denied that such illnesses overtake the well-fed, if less frequently than the starved, and the argument becomes a matter of probabilities.

The difficulty in all cases where no poison can be found is to prove that starvation, and not disease, was the cause of death. The post-mortem appearances in starvation are not conclusive, and when to this is added the fact that many children fed on the best foods, and tended with the greatest care, often die from simple inability to utilize the food given, it is clear that medical evidence must be greatly reinforced by circumstantial and direct evidence before a conviction can be obtained.

Deliberate "baby-farming" was rendered much more difficult by the terms of the Children's Act of 1908, and the subsequent Acts amending or replacing it.

Voluntary and Pretended Starvation

There are a few cases recorded in which persons have voluntarily abstained from food, liquid or solid, for the purpose of self-destruction. Suicide as a result of complete abstinence is, however, rare; for the person cannot usually resist the intolerable thirst or the desire for food when placed within his

reach. As it requires a period of at least eight or ten days for a fatal issue in these circumstances—i.e., in the *acute* form of starvation—the resolution to abstain can rarely be maintained.

Pretended fasting has been a subject of imposture at various times, and shows how even the educated public may be deceived, and how lucrative such an imposture may become. In *R. v. Jacobs and wife* (the Welsh fasting girl), a watch fully and strictly kept resulted in the detection of the imposture.

This girl, aged 13, is stated to have voluntarily abstained from any kind of food for a period of *two years*. She had kept her bed during that time, publicly exhibited by her parents as a girl of miraculous powers. Her lips were moistened with water once a fortnight, but, according to her parents, no food was taken. Four professional nurses were set to watch the girl, and the result was that, after passing through the usual stages of starvation, she died on the ninth day. She refused to take food at any time, and voluntarily accepted a lingering death rather than reveal the imposture. Her parents and those around her allowed her to die. An inquest was held, and a *post-mortem* examination showed that there was a layer of fat from half an inch to an inch thick beneath the skin of the chest and the abdomen. The contents of the chest were healthy. The stomach contained three teaspoonfuls of a semi-gelatinous substance, of the consistency of syrup, having a slightly acid reaction. The small intestines were empty, and presented no attenuation or thinning of the coats. In the colon and rectum there was half a pound of solid excrement in a hard state, which might have been there, according to the witness, a fortnight or longer. The liver was healthy, and the gall-bladder was greatly distended with bile; the kidneys and spleen were healthy, and the urinary bladder was empty.

The medical evidence at the inquest was to the effect that the child had died from exhaustion as the result of starvation, and the jury returned a verdict of death from starvation as a result of the criminal neglect of the parents in not administering food. They were tried on a charge of manslaughter. An attempt was made in the defence to refer death to shock, and not to the want of food. The medical facts relied upon in support of this theory were the presence of fat in the body and the absence of any thinning of the coats of the intestines; but, as was very properly pointed out, these conditions are only likely to be met with after long or chronic fasting, where the person has survived many weeks on insufficient or innutritious food. In the case of this girl, the only proved abstinence from food was during the last eight days of her life, and this period of time would not suffice for the entire removal of the fat and the thinning of the coats of the intestines. The prisoners were convicted of causing the death of their child by criminal negligence. The father was sentenced to twelve months', and the mother to six months', imprisonment.

In addressing the jury, the Judge said that "although the unhappy victim herself might have been, and probably was, a consenting party to the fraud, yet parents were bound to supply the wants of their children of tender years; and if the prisoners, in order to avoid detection of the fraud which they had entered upon, had refused their daughter food, they were guilty of manslaughter." In this case the food necessary to support life was not supplied for a period of seven or eight days. If the jury came to the conclusion that the deceased died because she had had no food during those eight days, he presumed that they would also come to the conclusion that during the two preceding years she had been supplied with food.

Dr. Tanner, an American physician, entered upon, and is stated successfully to have accomplished, a 40 days' fast. It is doubtful whether this was a great imposture, or a remarkable feat of foolhardy endurance. The conditions under which he was watched were by no means satisfactory. Water was taken at times freely; and at one time it is said that he increased in weight upon a watery dietary.[1] No complete medical history of this case has ever been published.

[1] *Brit. Med. J.*, 1880, 2, 215.

In December, 1909, in *Leigh v. Gladstone, Green, and Helby*, it was decided that the forcible feeding of women suffragist prisoners who had "gone on 'hunger strike", was legal; because, in the words of the Lord Chief Justice, the prisoners were "under the care of the Crown", which was bound to take reasonable and proper steps to prevent a prisoner from injuring himself or from taking his own life; and, in the opinion of Dr. Helby, further abstinence from food would have been dangerous to the prisoner's life.

DEATHS FROM ASPHYXIA. SUBOXIA, ANOXIA

DEFINITION OF ASPHYXIA

By custom and prolonged usage the term *asphyxia* has been applied to conditions in which the supply of oxygen to the blood and tissues has been reduced appreciably below the normal working level by some interference with respiration; in death from asphyxia it has fallen below the minimum necessary for the continuance of life.

A supply of oxygen and its successful utilization are primary requirements of every cell, and it is obvious that most of those things which cause malfunctioning or death of the cell operate by interfering with some part of the oxidation-reduction processes. The scope of oxygen-lack as a cause of death is, therefore, almost without limits.

In discussing asphyxia in its medico-legal aspects we shall use the term in a somewhat narrower sense, more particularly in reference to **mechanical interference with respiration** such as by suffocation, strangling, drowning and so on: we shall not use it in reference to the consequence of breathing an "irrespirable" gas, the absorption of a poison like HCN that interferes with the cell-oxidation enzyme system, or to states of narcosis.

It has been suggested that the term *asphyxia* is inappropriate for descriptive purposes, even in this narrower sense, because the Greek from which the word is derived means a state of "pulselessness" and this cannot be considered a primary feature of asphyxia. The terms *anoxaemia, anoxia* and *suboxia* have all been suggested to replace the older term asphyxia, but there are reasonable objections to each of them. A perusal of the standard Oxford dictionary gives the second meaning of asphyxia as "suspended animation produced by deficiency of oxygen in the blood". We look in vain for any definition of "anoxia" or "suboxia", though, of course, they will attain this recognition in due course.

This is not the place for an excursion into etymology or sea antics, but we may say in reply to those who prefer the terms anoxia or suboxia that the real meaning of *anoxia* is "without acid" and of *suboxia* "a deficiency of acid". Since the *p*H of the blood is lower in asphyxia, the terms anoxia and suboxia are no more appropriate etymologically. Nevertheless, we may consider anoxia or suboxia to imply a lack of oxygen a state of affairs which may become established for a very large variety of reasons, and the results of which vary according to the nature and extent of oxygen shortage, and the length of time it continues. In recent years this problem has been the subject of considerable investigation, particularly by Moon[1], by Swann and Brucer[2] and by Gordon and Turner.[3] These authors have

[1] Moon, V. H. Shock. London, Henry Kimpton.
[2] Swann, H. C., and Brucer, M. 1949. *Tex. Rep. Biol. Med.*, 1949, 7.
[3] Gordon, I., and Turner, R. 1951. *Arch. Path.*, 52, 160.

accomplished a great deal in their attempts to clarify the situation.

States of suboxia may develop as a result of disease, especially of the circulatory or respiratory systems, and also in consequence of a deficiency of hæmoglobin. Oxygen lack may also ensue from certain forms of interference with respiration; it may be caused by:—

(a) *Breathing a rarefied or vitiated atmosphere*, deficient in oxygen, as in high altitude climbing or flying, or near intense conflagrations;

(b) *Inhaling a gas which interferes with the normal oxygen carrying capacity of hæmoglobin* (e.g. CO or CO_2), or *prevents the normal working of the cell-oxidation enzyme system* (e.g., HCN)—or absorbing a poison like nitrobenzene or aniline, which *form methæmoglobin*;

(c) *Direct interference with the respiratory centre*, as by narcotic or anæsthetic poisons;

(d) **Mechanical interference with respiration**, as by suffocation, choking, hanging, strangling or drowning, and in consequence of fixation of the chest, as in "traumatic asphyxia".

It is, as we have indicated above, more particularly to those forms of oxygen shortage which are due to mechanical interference with respiration that the term "asphyxia" has been applied in common legal usage for so long. We shall continue to describe these conditions by this term, whilst recognizing that they constitute only a part of the whole problem of suboxia: the fact that they are associated with violence provides a further reason for devoting special attention to this group of suboxic states in a work primarily concerned with forensic matters.

Suboxia may vary in degree, be local or general, and may continue or be intermittent. Certain tissues are more sensitive to oxygen lack than others, nervous tissue for example being particularly vulnerable: even a mild lack of oxygen or a short lived failure of the circulation may cause mental confusion, loss of consciousness or physical signs of loss of function. Sudden deprivation of oxygen may cause almost instant loss of consciousness.

Suboxia is common to a number of conditions besides those in which mechanical interference with breathing has taken place. It results in the development of certain changes, common to all forms of oxygen lack, *which are indicative only of suboxia*, and before we can interpret them as evidence of mechanical asphyxiation we must establish:

(a) Evidence of mechanical *interference with breathing* such as *marks of pressure* over the face, finger nail marks on the neck, etc., or

(b) A local intensification of suboxial features that indicates—as in traumatic asphyxia—that the suboxia is *not* general.

When suboxial features are present the pathologist must seek a cause with diligence. He must exclude the possibility of natural disease—including disease of the blood, or causes of cardio-respiratory distress, and injuries capable of causing grave shock or loss of blood. When these are absent or trivial it is likely that the signs observed are connected with asphyxiation by some mechanical means, or with some form of narcosis. (See Fig. 51).

The more general features of the state of suboxia are:—

(1) *Cyanosis* with capillary dilatation and stasis—congestion and cyanosis.

(2) *Increased capillary permeability* causing œdema and serous effusions.

(3) *Petechial hæmorrhages*.

Persistent fluidity of the blood has been thought to be a feature of states of profound suboxia, but the work of Mole[1] has made it clear that this, when

[1] Mole, R. H., 1948. *J. Path and Bact.*, 60, 413.

present, is no doubt due to fibrinolysis. It is, therefore, not diagnostic of any special form or mechanism of death: though it may be common to states of suboxia, it is not consistently so—and, moreover, occurs in many other conditions (*vide supra*).[1]

1. **Cyanosis** is an index of diminished oxygen tension in the blood and reflects a rise in the proportion of reduced hæmoglobin. The colour change is pronounced in the skin—more especially where livid stains develop and in the organs in which the capillary and venous bed is plentiful, particularly the lungs, the meninges, liver, spleen and kidneys. The capillary dilatation that

Fig. 51. Intense cyanosis in narcotic poisoning. Deep livid discolouration of the face with occasional petechiæ of the brow and eyelids due to narcosis from aspirin poisoning, at first suspected to be a case of strangulation.

accompanies a reduction in oxygen tension promotes stasis and, in consequence of this, a vicious cycle of suboxygenation of the blood commences. The return flow to the heart is diminished, the pulmonary flow is both slowed and reduced in volume, and oxygenation is, therefore, deficient; this makes the condition worse, capillary dilatation and stasis increasing, cyanosis deepening.

2. **Increased capillary permeability** results from stasis and suboxia: the cement substance between the endothelial cells becomes defective and fluid transudes into the tissue spaces. This may result in frank gelatinous moistening of the tissues in more affected parts, in the brain or the myocardium, in œdema of the mediastinal tissues and of the lungs, and the

[1] Shapiro, H. A., 1955. *J. Forens. Med.*, 2, 1.

development of excess fluid in the pericardial and pleural sacs. Such changes can develop with great rapidity as can be observed in the sudden respiratory distress of a patient who is choking. Pulmonary œdema may develop with alarming rapidity in many conditions in which suboxia is present.

3. Petechial hæmorrhages, often referred to as "Tardieu" spots after the French police surgeon who described them in 1866, are not, it must be said at once, pathognomonic of asphyxiation—as Tardieu suggested.[1] They merely indicate stasis, suboxia and increased capillary permeability; there is no doubt that they tend to develop more pronouncedly in parts where capillary pressure and dilatation are most rapidly established—for instance in the scalp, eyelids and conjunctivæ above the level of constriction of the neck in strangling.

Fig. 52. Petechiæ in strangling. Showers of small hæmorrhages in the skin of the face and eyelids following strangling by the hands from behind, the victim being face down on the floor. (*R. v. Mardon*, C.C.C., 1940).

Local venous obstruction is in part responsible for the more rapidly developed capillary turgidity, early œdema and petechial hæmorrhages that are a feature of the slower deaths from constriction of the neck or compression of the chest. Indeed, as we shall point out, the distribution of such changes may often be diagnostic: they are important guides to the fact that the suboxic state is not necessarily a generalized one, but may be due to some local constriction.

SYMPTOMS AND SIGNS OF ASPHYXIA

When respiration is obstructed, the course of events passes through three distinct phases:—

1. The respiratory rate is quickened and the depth of excursion increased: cyanosis develops. The pulse rate is accelerated and the blood pressure rises. These are signs of physiological response to the decreasing oxygen saturation of the blood.

[1] Tardieu, H., 1866. *Ann. d'Hyg. Publ. et de Med. leg.*, 2, 357.

2. Cyanosis deepens and respiration becomes more laboured; œdema develops in the lungs and salivation adds to the fluid in the throat and glottis. The pulse becomes more rapid and bounding, and the blood pressure rises. The face, eyes and tongue may, when the throat is constricted, become turgid and bulge. Consciousness is clouded.

3. Respiration becomes irregular, punctuated by expiratory gasps; unconsciousness supervenes and convulsive movements may ensue. Minute vessels rupture both in the skin and internally, and blood may tinge the saliva and bronchial fluid (see Fig. 54). Vomit may regurgitate into the throat, and urine and faeces may be voided. The pulse becomes feebler and irregular, the blood pressure falls and death supervenes.

It is at stage 2 that the victims of gagging may be in danger of death, owing to fluid moistening and rendering impassible to air the gag or cloth bindings that have so far only made breathing more difficult.

In *R. v. Smith and Brown* (Kingston Assizes, 1951) an elderly proprietor of a grocery store was found bound and gagged on the bed, dead. A towel was bound round the nostrils and mouth, a gag tie lay under this, and a mouth gag was stuffed into the back of the throat: he had died of suffocation as a consequence of the gagging, a result which was no doubt not intended by his assailants.

In *R. v. Russell* (Reading Assizes, 1948) an old lady, recluse for 20 years in her large Maidenhead house, was found bound and gagged in a Victorian travelling trunk which lay in the ground floor hall: her home had been ransacked. She had died of gagging, the handkerchief used having become thick with saliva and mucus, thereby obstructing respiration more and more as the struggle to breathe became more laboured.

Though death may not have been intended, the law presumes everyone to be responsible for the reasonable and likely consequences of an unlawful act. Since a charge of murder may follow, the doctor should be aware of the gravity of the situation when making his examination at the scene of any crime of this kind.

over the nostrils or mouth, nor upon the neck. Four years later a woman was being questioned about the fate of her baby which could not be traced and, upon further questioning, she said she had suffocated it with a napkin (pressed over the face with her hand) in Esher Station, abandoning the dead infant in a suitcase on the Waterloo line. This was identified by a photograph (Vol. II.) as the child in question. (*R. v. Cronin, Kingston Assizes, 1945*).

An elderly widow, well-to-do and under constant care and regular medical attention (for senility and arterio-sclerosis) in a Worthing nursing home, died one night in the presence of the matron and a younger nurse. *The doctor who was called made an examination to confirm death*, saw nothing unusual, and issued a certificate for the conditions he had been treating. A burial order was remitted by the registrar, and the funeral cortege was moving when the younger nurse arrived in a state of great agitation at the doctor's house to say she had been present when a quarrel took place between her matron and the patient now dead, over the taking of a night draught. Abuse had given way to violence and matron had finally pinned the old lady on her bed, leaned over to *pick a pillow up in her teeth and held it over her face until she was dead.* Only scattered petechiæ in the eyelids and scalp, and a very few over the surfaces of the lungs remained to give proof of this—but they were enough to confirm the girl's story. The matron was convicted of manslaughter.[1]

Mechanical forms of asphyxiation can usually be distinguished from other kinds of profound suboxia, but the findings are likely to be equivocal when:—

(*a*) There are no marks of injury anywhere—as in suffocation by some soft object or overlaying fixation of the infant chest.

(*b*) The suboxial changes are either slight or not visible to the naked eye. These negative conditions may occur singly or together, and it is when there are no marks of violence and little suboxial change that it becomes difficult if not impossible to give proof of what may be suspected to have happened in life. Feeble infants or the elderly and infirm require little cardio-respiratory embarrassment to precipitate their death.

In *R. v. Thompson* (Old Bailey, 1949) an infant of three months was alleged to have been suffocated by the father, a youth of 17. *There were no marks of injury*, but intense asphyxial congestion and cyanosis marked the livid stains in the face, the lungs and other viscera: petechiæ were present in large numbers in the lungs and over the heart, and the œdema fluid that dribbled from the nostrils was blood-stained. The accused first said that the child was found dead on its face, but later admitted that in the absence of his wife, shopping, he had held the child's face down on a pillow because it had fretted. (See Fig. 51.)

In *R. v. Julia King* (Old Bailey, 1953) a woman who has become very distressed at the long and painful downhill course of her 76 year old husband's illness, endeavoured to suffocate him with a pillow behind the screens which lay round his bed in a London hospital. She was dragged off him by a passing nurse, but the old man was unconscious, deeply cyanosed. He did not die until three days later, and no *petechiæ were found, either at the time in the skin, or at post-mortem.* Though he had lost consciousness at the time "his general condition seemed to improve" (according to the hospital medical evidence) after the attempt to murder. He was found to have a carcinoma of the colon with a pericolic abscess and had been regarded as moribund some days prior to this incident. Upon trial accused received an admonishment from the judge and, with a stern warning that this was not to be taken as a condonation of "mercy killing", was discharged.

In the absence of marks of injury we may derive a strong guide to the nature of the obstruction to breathing from the distribution of petechiæ, but be unable to proffer conclusive evidence as to what happened. There are undoubtedly cases where strong suspicion, amounting almost to certainty, that of mechanical interference with respiration may arise, and in these it would be proper, even in the absence of marks of injury, to state that the particular

[1] *R. v. Southam, Lewes Assizes, 1950.*

distribution of the non-specific changes of suboxia raises strong suspicion of interference, as by constriction of the neck or compression of the chest, and that the absence of any other cause for such profound suboxia must lend weight to that suspicion. It may not be possible to go further than this, but such an opinion may provide an investigating police officer with a useful basis for further enquiry.

THE TIME TAKEN TO DIE FROM ASPHYXIATION

If, as a consequence of any such condition being unrelieved for several minutes, a sufficient embarrassment of breathing ensues, unconsciousness and death will supervene. The question is often put as to how long an interval of time might have elapsed between the significant part of the assault and loss of consciousness, and also between the onset of this and the time of death. These are very difficult questions, for the time interval must vary according to the rapidity and completeness of obstruction, the physical fitness of the subject and the rate at which the remaining oxygen in the blood and tissues is utilized. States of narcosis and of drunkenness may considerably shorten the period—as well, of course, as may any serious physical defect.

It is uncommon to have reliable direct evidence about the time taken to suffocate, strangle or drown, and as a general rule no precise time limit can be set: nevertheless, the time factor may be of the greatest importance to a proper understanding of a case, and, therefore, it must be considered in some detail. If it could be said that pronounced asphyxial changes might develop after seconds of complete obstruction, then the law might take a more lenient view than if it demanded several minutes of tight constriction of the neck. The former might be consistent with mere restraint, but the latter reflects a deliberate intent to cause grievous harm.

In *R. v. Southam* (Lewes Assizes, 1950) an unusual case of deliberate suffocation was witnessed by a nurse. In her presence, the matron of a nursing home was seen to be forcibly restraining an elderly woman who refused to swallow a sleeping draught. The matron pinned her down onto the bed, holding her arms, and drew a pillow across her face by means of her teeth, pressing it there for what the nurse describes as "several minutes" during which the old lady's struggles gradually ceased. It seemed unlikely, however (from other evidence) that as long as "several minutes" could have elapsed.[1]

In *R. v. Brown* (C.C.C., 1939) a man, out of work, penniless and dejected, sat on a bed by his wife's side upon return from shopping. He said (in a statement) 'I'm tired of this. Wish I was dead', to which she replied 'You're not the only one. I wish I were someties too'. He leant over to an attache case on the floor and took out a new white scarf, placing it in a single loop around her neck, and, saying 'It's easy this way', pulled it tight, holding it for "about half a minute". She was limp and fell across the bed upon release. He thought she was dead; she did not breathe or move again. Later that day he gave himself up.

In *R. v. Hickman* (C.C.C., 1910) a man strangled his sister with both hands on a short flight of stairs in a house they occupied with his Austrian fiancée. She offered little, if any, resistance: indeed, her spectacles were still set neatly on her nose and ears when she was picked up dead "a few moments later". Two other occupants of the house who had heard quarrelling between the two cease suddenly 'and then saw the accused come downstairs thought that "only a few seconds" had elapsed between the woman's voice being quietened and the man walking past the foot of the stairs. They did not think it could have been a matter of minutes

In these three cases, asphyxial conditions were well marked at autopsy, but in those where death is due to the intervention of a vagal inhibitory

[1] Simpson, K., 1953. *Police J.*, 26, 222.

reflex such changes are absent. The following cases illustrate the conditions of more sudden death:

In *R. v. Rourke* (C.C.C., 1934) a man laid both hands on the neck of the neurotic wife he had tended for so long when she called him a "clumsy old fool" for inadvertently treading on her toe in helping her out of bed. "She just went limp". No thought of killing her had ever entered his mind: he could not revive her. There were no petechiæ, and cyanosis was not pronounced.

A soldier playfully "tweaked the neck" of *his girl friend with whom he was dancing*—in full view of several other people—as they stood facing each other. "She dropped dead". No marks were found, and there were no signs of asphyxiation. A vagal reflex was assumed to have operated.

These are not asphyxial deaths, and the sudden nature of death is in itself indicative of some reflex vagal factor operating. There are, of course, cases where both vagal inhibition and some degree of asphyxiation operate together, but in assessing a time lapse for the process of asphyxiation this complexity of events cannot be presumed. The problem is dealt with in more detail in the section on strangulation.

One of the principal difficulties in assessing the time taken to kill is that one does not know from the evidence exactly when death took place, even when the killing is witnessed. The victim gets "blue in the face" and "goes limp" before dying; death appears to have taken place before, in fact, it has.

It is, however, quite certain that loss of consciousness may occur in several seconds and occasionally *death may take place very soon after, especially in the elderly or infirm,* only rarely taking as long as several minutes. Overlaying for but a few minutes may obviously be sufficient to kill if obstruction *to breathing is complete*—or require much longer if incomplete: indeed, incomplete obstruction to breathing, like transient constriction of the neck or compression-fixation of the chest, need not be fatal—at least not immediately so. Fazekas and Himwich[1] have shown that infants and young animals tolerate suboxia better than adults. In some asphyxiation states, especially in the newborn, death is delayed for a period during which secondary changes—in the central nervous system in particular—develop to a sufficient degree to precipitate death. These are dealt with in the section on Infanticide.

SUFFOCATION, CHOKING, DROWNING, HANGING, STRANGLING, TRAUMATIC ASPHYXIA

Having examined in some detail the more general features of acute suboxial deaths from all causes, we shall now describe separately the special features of those in which the condition is precipitated by some mechanical obstruction to respiration: it is for this group that the term asphyxia is specially retained.

Respiration may be obstructed mechanically in the following ways:—

1. By impeding or blocking the passage of air through the nostrils and mouth—i.e., *suffocation* or *smothering*. Gagging usually falls into this category.

2. By the impaction of foreign bodies in the glottis, larynx or main air tubes—i.e., *choking*.

3. By inhaling fluid—i.e., *drowning*.

4. By constriction of the neck—i.e., *hanging* and *strangling*.

5. By compression and mechanical fixation of the chest—i.e., *traumatic asphyxia*.

In each of these conditions a state of oxygen shortage develops with some rapidity, and, provided the subject is not debilitated by age or grave illness,

[1] Fazekas, J. F., and Himwich, H. E., 1943. *Amer. J. physiol.*, 139, 366

drugs or drunkenness, is likely to result in the rapid development of the symptoms and signs of asphyxia to which we have referred above. It must not be expected that every such case will reveal all the classic features, for there are many variables operating, and the consequences of respiratory obstruction by these differing means must naturally vary. But in each we should expect to find, if to a varying degree, both the local physical and the general suboxial features of asphyxiation.

Naturally, when a pillow is held across the face there is far less likelihood of finding evidence of this event than in strangulation by the hand or by a ligature, but in all cases a painstaking search for marks as well as for the general signs of suboxia should be undertaken.

SUFFOCATION

Suffocation, of which smothering constitutes a form, consists of a mechanical obstruction to breathing by some external means, usually by closure of the mouth and nostrils. It is a common accident of infancy—though possibly over-rated in frequency (*vide* Vol. II)—and demands some care for its protection: it is one of those forms of asphyxiation in which local marks are unlikely to be present.

Fig. 53. Petechiæ in gagging. Petechial hæmorrhages in the face of a girl murdered by stuffing the mouth and pharynx with a handkerchief and bedding. (*R. v. Armstrong*, C.C.C., 1939).

In its most simple form the mouth and nostrils are completely blocked—as by bedding or soft clothing, by the hand or by gagging: but cases occasionally occur where the face gets buried in feathers, hay, flour, sand, etc., where

an element of choking is added. It is not essential for obstruction to be complete, but merely to cause a serious interference with access of air. A case seen in a poor district of East London in which there was nothing more than a privation of good air illustrates this.

During a very cold spell of winter, a family of seven slept together in an unventilated room measuring 10ft. by 9ft. The window and door were closed and a heavy cloth hung over them. The family retired at 10 p.m. and at 7.30 a.m. twins aged two months were found dead by the father. Both lay together in a cot on their left sides; both were cyanosed, and a trace of vomit lay at the lips. Signs of profound suboxia were present and there were occasional petechiæ over the under surfaces of both left lungs. The five other members of the family awoke in the ordinary way, and three of them complained of headache—a common symptom of suboxia—which passed off during the morning.

These conditions, simulating those of the "Black Hole of Calcutta" in which 123 out of 146 persons perished in a 20 ft. square room from oxygen shortage, are closely paralleled by those in which infants come to die under heavy bedding or buried in the soft bodies of their mothers—not uncommonly at the breast, as the mother falls asleep whilst feeding the child.

Certain forms of accidental suffocation arise from the experimental tying or gagging or enveloping of the head in a sack or bag which characterize masochism in adolescence. Consciousness may be dimmed or lost in such cases and the suboxia of brain and muscular system, even when the subject retains a certain degree of consciousness, may be such that he is unable to free himself from the dangerous position into which he has drifted.

A youth of 25 who was experimenting in under water ("frog") swimming at home in a bath—with a poorly functioning oxygen apparatus—was found dead partially submerged, face down in 1¼ ft. of water. There was no suspicion of foul play. Extreme cyanosis and profound visceral congestion marked the tissues in all parts, and the face, shoulders and extremities were livid, cyanosed and shot with petechial hæmorrhages due to extreme oxygen lack. There was no evidence of drowning.

A suboxic state is occasionally seen in grossly unskilled anæsthesia, and in those uncommon cases where a carbon dioxide cylinder is used in mistake for oxygen.

Where a gag is packed into the mouth and throat in such a way as to obstruct breathing through the mouth and nose, or where a face gag is tied over the nose and mouth, suffocation may occur as soon as saliva, mucus or œdema fluid moisten and obstruct the cloth "pores" (*vide supra*).

In *R. v. Russell* (Reading Assizes, 1948) an elderly recluse, a very frail old lady living alone in a large house at Maidenhead, was found dead, bound and gagged, in a Victorian travelling case in the hall of her own house. The place had been ransacked and a solitary fingerprint led to the arrest of a man who was later tried and convicted of murder by criminal assault causing suffocation. The old lady had been left on a chair, gagged, whilst the accused ransacked the house, but was found dead on his return to the ground floor; the gag was moist with saliva.

The post-mortem appearances are those of mechanical asphyxiation, often developed with less rapidity than in choking, hanging or strangling, and showing, therefore, even deeper generalized congestion, cyanosis, vascular stasis, œdema and often more numerous petechiæ. Occasionally, patches of white pressure marking may indicate the areas of contact with bedding or some obstructing surface which may be defined as extending across the nostrils and mouth. A dribble of blood-tinged œdema fluid may issue from the nostrils and mouth.

Suffocation by Accident, Suicide and Murder

The careful assessment of suffocation is of great importance to the investigating authorities who may have to decide whether the circumstances justify a criminal charge. The problem for the pathologist is a particularly difficult one in infancy, for, during the first few months, the hold on life is still slender, and the relatively tender and helpless infant may all too easily:—

(a) *Succumb to natural disease* which has been insidious in onset and not been apparent to those in charge.

(b) *Turn on to its face* and thereby become suffocated irrespective of the nature of the bedding.

(c) *Vomit*—either after feeding or, as a terminal event, in consequence of asphyxial conditions.

(d) *Become victim to foul play* so lacking in violence as to leave no mark— by narcotic or other poisoning, suffocation by the hand or bedding, etc.

(a) *Disease.* The neonatal problem is dealt with more fully in the section on stillbirth and infanticide, but something must be said of it here in relation to accidental and homicidal suffocation in infancy. Each year sees over 2,000 infant deaths from "asphyxia and atelectasis" due to natural causes in England and Wales alone and, in addition, over 100 cases of "accidental mechanical suffocation" and some 10 of infanticide by suffocation.

Suboxia is intimately concerned with something like 50 per cent of neonatal deaths from all causes, and difficult or prolonged labour, encirclement of the neck by the cord, inhalation of meconium or other birth fluids, and atelectasis due to prematurity must all be eliminated before suffocation is thought of as a cause of asphyxial changes. Petechiae are to be found in many neonatal autopsies and the finding of these haemorrhages together with other signs of suboxia does not in itself indicate that the death is suspicious.

In the later period of infancy short-lived natural disease, often revealed only upon microscopy, is commonly responsible for the erroneous belief that suffocation is responsible for death. Keith Bowden (1950)[1] in Australia and Werne and Garrow[2] (1953) in the United States have drawn attention to the frequency with which, if a painstaking microscopical examination is performed, some developmental defect or natural disease is found. It must not necessarily be assumed, however, that such conditions must have been the cause of death. Before that is decided we must assure ourselves that the disease found was capable of causing death, and that there is evidence, or at least a presumption, that such disease did in fact cause death. Where the bronchcolar tree is blocked by muco-pus, or the lung is consolidated by pneumonia to any considerable degree, where the myocardium is found to be degenerate or sclerous, or the kidneys pyelonephritic, this may be considered adequate; but the precise mode of death may be more difficult to define.

(b) *Lying on the face* or against the parents must not be assumed to be sufficient evidence in itself of the cause of death. It is quite possible that natural disease is present, and Davison,[3] the Birmingham Coroner, from a perusal of the 1916–44 statistics of deaths in infancy attributed to mechanical asphyxiation whilst in bed with parents or others, found a sharp fall in such verdicts from the year 1925 when the cause of death commenced to be investigated by autopsy. The position of the body may be suggestive, but that is

[1] Bowden, K., 1950. *Med. J. Aust.*, 1, 65.
[2] Werne, T., and Garrow, I., 1953. *Amer. J. Path.*, 29, 817, 633 and 833.
[3] Davison W. H. 1945. *Brit med. J.*, 2 251.

not in itself conclusive of the mode of death. It cannot, moreover, be used as evidence to show *how* the child came to be suffocated, for such a position may be assumed accidentally or effected wilfully.

(c) *Vomit soiling* of the glottis and bronchial tree is a common terminal event in many states of profound suboxia, whatever their cause, as well as an occasional primary mechanical cause of obstruction to breathing. It is probably of central origin, the vomit centre of the brain stem being first stimulated and finally depressed by oxygen lack. Such an event may make it additionally difficult to examine the bronchial tree for inflammatory changes, and may "balloon" the lungs to such a degree as to obscure the pre-existing collapse. Microscopic examination should always be undertaken before a definite opinion is expressed.

Fig. 54. Suffocation in bedding. Livid discolouration of the skin and dribbling of blood tinged œdema fluid from the nostrils in a child held on his face in a cot with nostrils and mouth buried in the pillow. (*R. v. Thompson*, C.C.C., 1949).

(d) *Foul play*, in the absence of gross injury, must not be assumed without great care in eliminating the factors set out above. The position of the child is seldom in itself sufficient for such assumption, but occasionally the mode of disposal of infants may give rise to the strongest possible suspicion that the suboxial features they exhibit are not due to natural or accidental causes.

The following case illustrates some of the difficulties which may be encountered —

In *R. v. Price* (C.C.C., 1950) two infants (18 and 38 months of age) were found dead in a pram, thrust out of view into some bushes just behind the promenade at Bognor. No marks of significant injury were found but there were signs of asphyxiation the trivial character of which raised suspicion of an adjuvant factor being concerned. Microscopical examination proved negative but analysis of the viscera revealed the presence of carbromal in each child. The father later admitted that he had given each child 6 or 7 carbromal tablets prior to suffocating them with a pillow.

It is seldom that any indication of the precise manner in which an infant has died by suffocation or smothering is revealed by direct examination or autopsy. The pathologist who has eliminated natural disease and poisoning is left with no positive evidence of anything but acute respiratory embarrassment. In such cases he should confine himself to the opinion that the process of breathing was obstructed without attempting to define the method. Most cases of overlaying fall into this category.

In *R. v. Cronin* (Kingston Assizes, 1944) a mother suffocated her six months old infant by means of a napkin held in her hand at Esher railway station, placing the body in a portmanteau and leaving it in the train. The trunk was opened in the luggage office at Waterloo station within 48 hours, since it was not claimed, and autopsy revealed pronounced asphyxial changes—but little to account for their development. Some mild bronchitis was also present. Suffocation was suspected and an open verdict was returned at the Coroner's inquest. The mother remained unkown. Four years later the accused was being questioned about the fate of her baby when she made a false statement: it was suspected that she had disposed of it by foul play and further questioning elicited the facts set out above.

In adults the problem is a little easier. In accidental suffocation the circumstances in which the body is found *usually render the verdict obvious*. In most cases of homicide the face is found covered, a gag or some similar obstruction is present, or there has been sufficient violence in pressing some object on to the face to make the conditions recognizable. It is not always so, however, for adults may fall easy victims to suffocation when drunk, disabled or narcotized, and in such cases no marks may be left owing to the absence of any struggle or resistance.

In *R. v. Heath* (C.C.C., 1946) the first of two victims, Margery Gardner, was found dead, *face upwards* in bed with her hands tied by the wrists behind her, and her ankles also tied. She was naked, and both bite marks and whipping impressions were visible on the body. Some of these lay across the back, and as the face was turgid and blotchy—and asphyxial petechiæ were present in the lungs—it was suspected that, whilst turned *face down* into the bedding and being whipped she had met her death from suffocation. In fact, enquiry revealed a scarf soiled by saliva in an attache case left by Heath at Bournemouth railway station, and he subsequently admitted having bound and gagged his victim before assaulting her. There was nothing at autopsy to indicate these details.

In the absence of marks of violence or other suspicious circumstances there is nothing in the medical examination to justify an opinion on the nature of the obstruction: it may be presumed to be mechanical and external when other factors—disease, narcosis, profound drunkenness, etc.—are absent. The circumstances will usually decide the issue.

In *R. v. Norman* a nursemaid of 15 was charged with murder by suffocation of a child 15 months of age, which had been in her care. Suspicious marks of violence on the lower lip of this child were attributed to pressure on the mouth, but the medical witnesses conceded that they might have been accidental. The girl was acquitted of murder but convicted of attempted murder.

There were three other charges of murder by suffocation laid against her, and the evidence given threw some light on her probable methods. Thus in a charge of the attempted murder of a boy aged ten, evidence was given that the boy was heard to

give a startled cry and, on entry being made into the room, he was alleged to have said that the maid had tried to strangle him while he was asleep. He had been awakened by feeling a hand on his mouth and throat and upon his attempting to cry out, had been offered a sweet by the girl and told not to cry. She had been lying upon him and on the occasion on which she was disturbed was caught in the act of getting off the bed.

Careful examination of the inside of the lips in a strong light may reveal scattered small bruises where the soft tissues have been pressed against the teeth, no evidence of which is to be observed externally, and dissection of the subcutaneous tissues of the back of the neck may equally reveal bruises from the pressure of fingers, no sign of which is visible on the skin surface.

Suicide by asphyxiation is uncommon, but by no means unknown, the circumstances being, as a rule, amply indicative of the nature of the act.

A woman locked herself in her room with her young child, placed herself under the bed-clothes, and desired the child to pile the several articles of furniture in the room upon the bed. When the apartment was entered, some hours afterwards, the woman was found dead; she had evidently been suffocated. Had not the child clearly detailed the circumstances, a suspicion of murder would have arisen.

A case of suicide by suffocation was reported in the *Annales de Medecine Legale*, in 1927 and in the *Edinburgh Medical Journal*, Vol. 56 (1812) another remarkable case of self-suffocation was reported:—

A woman confined in prison, forced a plug, 3½ inches long, consisting of pieces of blanket tightly rolled, into the back of her throat. A medical certificate was given that the deceased had died of apoplexy. The body was sent to one of the anatomical schools, and on reinspection, it was accidentally found that the throat was firmly blocked. At an inquest it appeared that the deceased had thrust into her throat a large piece of rag, which had been used in applying a lotion.

A man confined as a prisoner in a cell committed suicide by suffocation. He was found lying on his face, dead. He had thrown his bed on the floor, filled his nostrils with pieces of rag, his mouth with a handkerchief, and had tied another handkerchief over his mouth, after which he must have thrown himself upon his face.

CHOKING

Choking is closely related to suffocation in its mechanics and effects but the term is used to define a particular form of asphyxia by the blocking of the glottis or the windpipe by a solid substance. The obstruction to respiration may be due to an abscess of the glottis, œdema of the glottis, diphtheritic or influenzal membrane or a new growth. It is more commonly, however, due to sudden blocking by an inhaled or swallowed foreign body.

A man returned home with several others from a party somewhat the worse for drink. A few minutes later he sat back in his chair "blue in the face" and seemed to die at once. Autopsy revealed an unmasticated onion 2 inches in diameter lodged in the glottis.

In other cases, a wedge of meat, false teeth, an overcoat button, and a segment of orange have been found, and of course, many cases in which vomit regurgitation has caused death. Such cases are more common in imbecile children and mental hospital patients who "bolt" their food—or, indeed, cram into their mouths various unsuspected materials such as marbles, soap, faeces, shavings, etc.

Almost all chokings are accidental but Targett[1] once reported a remarkable case of homicidal choking to the Medico-Legal Society. It is worth quoting:—

A child of ten months of age was brought into Guy's Hospital with symptoms of laryngeal trouble; it died shortly after. Targett performed the autopsy, and

[1] Targett, J. H., 1905. *Trans. Med-leg. Soc.*, 11, 110.

found in the stomach two corks of the size to fit an ordinary medicine bottle, and in the glottis a much larger one firmly fixed, causing mechanical obstruction as well as inflammatory œdema. At the inquest, false evidence was given, which resulted in an open verdict. Ten years later, in consequence of a confession, the case was reopened before Mr. Justice Darling at the Central Criminal Court, when the following evidence was given. The baby, and a man (the man and his presumed wife had taken the baby to lodge for payment) had been left for two hours alone in the room; on the woman's return, the child presented the symptoms for which it was admitted to Guy's Hospital. Targett repeated the evidence which he had given ten years previously; the jury returned a verdict, largely based on the accused's confession, of manslaughter.

In comment on this case we may say how difficult it is to disprove the defence that an infant has placed such things in its mouth and choked by accident: the same is true of suspected homicidal poisoning in very young children.

One further form of choking demands separate attention. It is that which occurs when persons are precipitated head first into some mass of loose material which covers the face and is drawn into the air passages by the effort to breathe. We have seen such deaths from falls into a flour bin, into corn and from stumbling into mud. Death is not dependent upon the solid plugging of the glottis and air passages—indeed, it is more common to find mere traces of foreign matter in the bronchial tree. The lungs are commonly ballooned as in drowning and, though emphysema and stasis are established, the over-distention of alveolar sacs prevents the development of petechiæ in any number.

Devergie reported a case, in which a man was murdered by having his face forcibly thrust into a heap of corn. A quantity of the corn was found blocking up the mouth and nostrils, and some of the grains had been drawn into the air-passages by forcible aspiration, as well as into the stomach, by swallowing, and even into the duodenum. That violence had been used was proved by the marks of indentations produced by the grains of corn on the face, as well as by excoriations (indicative of resistance) on the hands. The facts were quite inconsistent with the supposition of suicide or accident.

In some cases of impacted foreign body in the throat, glottis or bronchial tree, death ensues with such lightning rapidity that it is clearly not due to the development of suboxia: no sufficient time passes for these changes to mature. In such cases it must be presumed that the mechanism of death is a vagal inhibitory process.

A small child, playing with others in the street, was galvanised into a precipitate rush to the pavement by a car horn. When the vehicle had passed, she still lay on the kerb across which she appeared to have stumbled: she was dead. At autopsy an inverted toy balloon was discovered, impacted in the larynx. There were no asphyxial changes, and a vagal reflex was assumed to have caused sudden death. Enquiry revealed that the child had been seen blowing up a toy balloon a moment before the car passed.

Such cases are also deaths from choking, though the mechanism of cardio-respiratory failure may be slightly different.

Further references to vagal inhibition reflexes operating from the throat and glottis are to be found in the sections on strangling, hanging, drowning and anæsthetic fatalities: the mechanism in each is much the same as in choking.

cause the person to rise again, even if instinctive efforts at self-preservation are not made. On coming to the surface, violent attempts *to breathe are at first made*; but, while air is inhaled into the lungs, water passes into the mouth and some of this may be aspirated into the air passages, causing violent coughing. If the individual can swim he pushes along the surface of the water till he is fatigued; then he is in the same predicament as a person who cannot swim. Whether from the outset he is in difficulty, or comes to it from fatigue, he makes irregular movements with arms and legs, seizes anything within his reach, clutches at and lays hold of any nearby objects, whether fixed or in motion, and alternately sinks and rises. Each time that his head dips beneath the water, some fluid is drawn into the bronchial tree. The same is observed to occur when the head comes to the surface; air and water are then inspired; the latter is partly swallowed and partly ejected by an involuntary fit of coughing, provoked by the reflex effect of contact of water with the glottis. The efforts at coughing cause the expulsion of air from the lungs and an imperative desire to breathe is felt; but, the head being only partially out of the water, further quantities of air and water are taken in. The struggle for life may continue for a longer or shorter period, according to the strength of the person; but eventually exhaustion ensues, and the drowning person sinks beneath the surface, opens his mouth, endeavours to draw in air, but only water enters, and some also enters the stomach. The blood in the lungs becomes profoundly suboxic; insensibility follows, convulsive movements of the body take place, and the body sinks to the bottom.

There is a common tradition that a person in the act of drowning succumbs only after "going down for the third time". This may sometimes happen, but there is certainly no reliance to be placed on such belief. That a person rises at all is due partly to the fact that the specific gravity of the body is very nearly that of ordinary water, but more certainly due to the fact that very slight movements only are required to bring the body up, for it is found that when no such efforts are made the body may sink at once on being immersed. Much may depend on the quantity of air trapped in the lungs by the last few gasping inhalations.

The Ultimate Cause of Death in Drowning

Varied opinions have been expressed as to the precise manner in which death takes place in drowning. These scarcely possess even historical interest now, for every competent person accepts asphyxiation as a satisfactory and complete explanation, i.e., an asphyxia produced by the entry into the air-passages and alveoli of an irrespirable medium which effectually prevents aeration of the blood. Water penetrates into the minute air-tubes, and thus no air can enter to replace that which is trapped and has already expended its oxygen. Hence the blood which circulates in the first few minutes after submersion contains too little oxygen for the continued support of life; but life remains, and is, for a short time after immersion, capable of resuscitation. The action of the heart gradually slackens, becomes irregular, and finally stops. It is at this period of complete arrest of circulation that asphyxia becomes irreversible.

In 1862 the Medico-Chirurgical Society published[1] a report upon some experiments in drowning and in 1948 Swann —and later Swann and Brucer— repeated the experiments in the light of modern knowledge and advance in technical method. Both reports are worth quoting:

[1] *Report on Suspended Animation, 1862. Med.-Chir. Trans.*, p. 449.

It was found by the Medico-Chirurgical committee that *four minutes'* complete submersion in water effectually killed dogs, although after removal from water the heart continued to beat from four to five minutes.

A submersion of a minute and a half was found sufficient to destroy the life of a dog. After only one minute's submersion—or with a large dog after a submersion for a minute and a quarter—the animal recovered almost immediately on removal from the water. Other experiments showed that in asphyxia from simple privation of air, a dog would recover after *four minutes'* suspension of breathing; but, as in drowning, a *minute and a half* was sufficient to destroy life without any sign of recovery, "it was obvious that some additional cause was at work to render drowning more speedily fatal than simple asphyxia." This was attributed to the introduction of water by aspiration into the minute air-tubes and alveoli of the lungs. Two dogs of the same size were submerged at the same moment, but one had his wind-pipe plugged, so that neither air nor water could enter, while the other had the windpipe open. After two minutes they were taken out together. The one with the windpipe plugged recovered at once; the other died. In three experiments, dogs with their windpipes plugged were kept below the water for *four minutes.* The animals recovered perfectly when removed from the water. An inspection of the bodies showed that, in animals simply deprived of air by plugging the windpipe, the lungs were merely congested; but in those which were submerged in their ordinary condition the lungs, besides being more congested and showing ecchy-mosed points on the surface and in the substance, contained in their bronchial tubes a froth formed of water, blood, and mucus, completely filling the small air-tubes. The respiratory efforts made by the animal before death had caused the production of this froth, which formed a mechanical impediment to the further inhalation of air. The mucous froth issued from the lungs on section, and appeared to penetrate their entire substance, which was saturated with water tinged with blood. The lungs were "sodden with water, heavy, soft, and doughy, so that they retained an impression produced by the finger and were incapable of collapsing." In the lungs of animals which recovered after a short submersion, little or none of this mucous froth was found, whereas in the fatal cases, the quantity was great in proportion to the time of submersion. The Committee felt that there was no doubt that it was produced by the violent efforts to breathe which are made within a minute after submersion.

These experiments served to explain a very disappointing termination to many attempts at resuscitation, viz,. that persons who have been rescued from water in a living state, and who have apparently recovered from the effects of submersion relapsed into unconsciousness and died after some minutes or hours.

Swann and Brucer,[1] repeating these experiments in dogs, recorded the arterial and venous pressures, heart rate. ECG, pulmonary ventilation and respiration rate, blood pH, oxygen and CO_2 tension, lactic acid—and other measurements of less immediate interest.

The general conclusion drawn from observations in cases of death from rapidly developed anoxia in drowning, was that circulatory and respiratory failure occurred more or less synchronously, and appeared to be due to anoxia of both the myocardium and the respiratory centre, independently, Capillo-venous congestion and petechial haemorrhages developed with remark-able rapidity, and were identical with those changes that occurred in other acute asphyxiations by mechanical means. The haemodilution that was such a feature of drowning in fresh water was a disturbing feature and seemed to be directly responsible for the earlier death—in some four to five minutes—in these cases, as compared with the eight to twelve minutes required in salt water.

for instance the water, may have been foul, and a septic pneumonia may have supervened—a far more common event than is usually supposed [1] In the very young or very old and feeble, mere cold and exposure may have caused fatal exhaustion, or rarely indeed, violent efforts at escape may burst an abscess or aneurysm. These may be termed **secondary causes of death in drowning**. No general rules can be laid down as to how such cases should be considered from the point of view of medical evidence if legal proceedings should be commenced; each case must be decided on its own merits.

In June, 1952, a man whose life was insured under accident policies for a sum of £105,000 was forced to take to a dinghy, when his motor yacht went adrift off the Cornwall coast. He fell into the sea in trying to get into the dinghy and managed to climb in only after a struggle lasting about ten minutes. Rescuers arrived about half an hour later and he was taken ashore in an open boat, landing three-quarters of an hour afterwards, "cold and exhausted." He was taken home where he revived somewhat, but next day he felt unwell and by the afternoon of the third day a doctor who was called in found signs of pneumonia. He died the next day, and autopsy confirmed the diagnosis. The policies necessitated "accidental violent external and visible means" in order to relate any event to death, and immersion was admitted to constitute this (*vide Isitt v. Railway passengers*, 1889); the rapid development of pneumonia, it was not contested, so soon after immersion, cold, exposure and exhaustion must be regarded as a direct consequence of the fall into the sea.

We must now, however, consider a very important fact of somewhat different nature, namely, that many bodies which are taken out of the water do not present the classical changes of drowning. The explanation of such cases is of the highest medico-legal interest and importance, and must now be discussed.

Other Causes of Death in Immersion

Some persons who fall into water sink at once without any effort to survive. Such an event indicates either some affection of consciousness, or mechanical difficulties in using the limbs. The latter will be discussed later when the question of accident, suicide, or homicide has to be decided; the former may now be considered. The following possibilities are relevant:

(a) Deceased may have been stunned by the fall into the water or even have been killed by this means, his body striking some solid object in its fall.

(b) He may have been so intoxicated (or otherwise rendered insensible) as to have been unable to help himself. Cramp in the muscles of the limbs may prevent a struggle for life.

(c) Fright may have produced such a shock as to have caused death by failure of the heart's action, or shock from the sudden application of cold to the skin may have caused sudden failure of the heart. It has been demonstrated by experiment that in drowning there is often a reflex inhibition of respiration followed by violent compulsory respiratory efforts; it is possible that primary inhibition may in certain cases remain permanently till death ensues.[2]

or feeble; in the first alternative the signs of asphyxia from water in the lungs will be entirely wanting, and in the latter alternative probably not very marked—in proportion to the vigour of respiration; hence the *post-mortem* appearances will vary. These variations in *post-mortem* appearances are of the utmost medico-legal importance, for the first question that will arise in the inquiry will be, "Did this person meet his death by drowning?" It must be admitted that, if *all* signs of death from aspiration of the medium are absent, then the cause of the unconsciousness must have been sufficient in itself to kill. The matter will be referred to again (*vide infra.* p. 481).

We find that out of 100 bodies removed from the water dead, where death was due either directly or indirectly to immersion, if the body were removed *immediately after death* and examined soon after removal, the ordinary appearances of drowning were present in about 35, they were imperfectly apparent in about 60, and were wholly absent in about five. As time passes and decomposition changes supervene the difficulties multiply, and by the second or third day, according to the environment, the chances of demonstrating the classical features of drowning will have gone. The fact of drowning is often assumed by inference from the absence of other causes for death. Microscopy will help greatly in such cases.

Time Required for Death in Drowning

A doctor may be asked what period of time is required for death to take place by drowning. Persons who are strong, good swimmers retain their presence of mind, and provided they have not been injured, may support themselves for a long time in the water; while others who are weak, delicate, unaccustomed to the water, injured or frightened, may struggle only for a few seconds and then sink exhausted.

The experiments detailed above show that complete submersion for 1¼ minutes in animals is fatal, provided that ordinary respiratory efforts are made while submersion is complete. They further show that if respiratory efforts (by which water or air and water enter the mouth) are completely suspended, simple deprivation of air for as much as four minutes need not be fatal.

The power of recovery in human beings is, by and large, in inverse proportion to the penetration of the substance of the lung with water, and speaking generally, this amount and penetration as well as the degree of sub-pleural ecchymosis is proportional to the efforts made at self-preservation.

The explanation of the differences in the experimental times for a fatal event offers us a clue to the varied results seen in cases of accidental and suicidal drowning in which the experimental conditions do not uniformly apply. The persons concerned reach the water or become submerged in all sorts of conditions, e.g. stunned, drunk, epileptic, fainting, etc., under which respiratory efforts are more or less in abeyance, the *totality* of submersion is more or less problematical, and on these factors depend the *post-mortem* results and also the time within which the different conditions appear.

The following facts, which have been observed, are of interest:

1. Sponge and pearl divers (without apparatus) cannot remain down for more than two minutes.

2. A woman exhibited that she possessed the ability (attained by long training for the purpose) to remain submerged for two and a half and even three minutes.

3. Complete insensibility has occurred after one minute's submersion.

4. Of two divers (with apparatus) whose supply of fresh air was cut off, one submerged for one and a half minutes lived, one submerged two minutes died.

5. Reports from the Royal Humane Society and similar bodies show cases of recovery after a minute and a half, and even *after three minutes'* submersion; there are longer periods recorded, but in all of them it is noted that complete submersion was doubtful.

It would seem that the earlier or more loosely recorded cases of recovery after submersion for more than seven to eight minutes are wholly unreliable. It is possible that some air may be drawn down in the clothing or in. the sail of an overturned boat, etc. Such a case actually occurred where a little dog remained for 20 minutes under the seat of a capsized boat, and was none the worse for its temporary imprisonment.

Post-mortem Appearances in the Drowned

In conducting the examination of the body of a drowned person, it is necessary to remember that the external and internal appearances vary according to the length of time during which the body has remained in water and also the period that has elapsed after its removal and before it is examined. Thus, in reference to the bodies of two persons drowned by a common accident, if one is examined immediately, and the other is not removed from the water until after the lapse of some days, and is then inspected, the appearances will be different. So if two bodies are removed at the same time, and one is immediately examined, while the other is not inspected until some time later, the proofs of drowning which may be discoverable in the former may have disappeared in the latter.

It is impossible to lay too much stress on the necessity for examining *as soon as possible* a body taken out of the water. The rapidity with which putrefactive changes occur in bodies taken from the water and the rapidity with which some of the most essential signs of asphyxia from the aspiration of water may disappear are extraordinary – if well recognized.

EXTERNAL APPEARANCES

Where the body has remained in the water only a few hours after death, and the autopsy has taken place immediately after its removal, the *skin* will be found cold and pallid, sometimes "pimpled" in the form of "cutis anserina", or goose skin. Casper considered this to be a usual accompaniment of death from drowning, but the condition is due to the contraction of the erector pilæ muscles and is found both in life and in many forms of death. It may be produced *after death*, as has been more than once observed. Bogdan[1] described a case in which cutis anserina and retraction of the scrotum and penis occurred 28 hours after death. This was caused by placing ice in contact with the body. Sudden fright or sudden application of cold to the skin usually produces goose-skin, and therefore it is commonly found when a body has fallen into water in a living state.

In men who have fallen into the water alive and have been drowned, extreme contraction of the penis has been repeatedly observed. No deduction as to death from drowning can, however, be made from this condition. If we consider the mechanism by which erection or the reverse is brought about, there can be no difficulty in accepting the condition as perfectly compatible with drowning or indeed other exposures to cold.

[1] Bogdan, G. 1922. *Ann. de méd. lég.,* **2**, 260.

The skin is often blotchy from irregularly distributed livid discolourations. These may be bright red if the water was cold. The eyes are half open, the eyelids livid, and the pupils dilated, the mouth closed or half open, the tongue swollen and congested, frequently pushed forwards to the inner surface of the lips, sometimes indented by the teeth; and the lips and nostrils are covered with fine lather-like froth which oozes from them. If wiped away it tends to recur: it is due to the elasticity of the over-inflated lung, now returning to its normal size.

The sodden and wrinkled skin ("washerwoman's hands") is caused by the action of the water on the skin, and has no bearing on how death occurred, though it may be important in enabling us to state approximately how long the body had lain in water (see. p. 194).

The body and limbs of a person recently drowned are usually found relaxed; but cadaveric rigidity appears to come on quickly, and the body may rarely be stiffened in the convulsive or distorted attitude which it had at the time of death. In one case, the body of a man who was drowned under ice was found with the arms stiffened in the attitude in which he was endeavouring to support himself on the ice.

Careful notes must be made of any abrasions on the fingers and elsewhere on the body. Such may be due to the natural effort of drowning persons to grasp any object within reach, and in his efforts to extricate himself may easily excoriate his fingers or even tear them badly, especially the nails, in trying to get a grip on a hard body too large for the grasp of the hand. Precisely the same explanation will account for the presence of gravel, sand, mud, weeds, or any substance found locked within the hands or beneath the nails, the precise nature of which it is most important to notice. Substances floating in the water are sometimes found in nose, mouth, or ears. The presence of all these things is of much more importance as evidence than their absence, for it is obvious that there may be, in many circumstances, nothing for the drowning person to grasp. Again, if he were insensible, or in a state of syncope, he would not be capable of making such an effort.

External appearances, of themselves, are of little or no value in determining the fact of death from drowning. Autopsy—and preferably also microscopy and analysis—form important adjuncts. We must now proceed to consider these.

INTERNAL FINDINGS

In the body of a recently drowned subject, both pathological and microchemical changes are to be found. The venous system is generally found engorged with dark-coloured blood, which may be either coagulated or uncoagulated. If death has not taken place from drowning, or if the body has remained a long time in water before an inspection is made, the characters about to be described will be absent. Even if developed, the process of decomposition will have disposed of them. It will also have added changes, like the transudates of fluid tinged with hemolysed blood in the pleural sacs, that the pathologist must recognize as natural concomitants of *post-mortem* disintegration of the visceral pleura. The classical changes to be described below are variable.

The lungs. If the person has died recently by drowning the lungs will be found distended, completely filling the cavity of the chest, and, owing to the penetration of their substance by water, enormously over-distended. An

impression made upon them by a finger remains; a similar impression can also be made in emphysema, but here dryness of the lung is a marked feature. On making a section of any part of the lungs a bloody, frothy liquid escapes, air and water being mixed together in the air-cells. The *throat, glottis, trachea, bronchi,* and even minute *air-tubes* of the lungs, in a recently drowned subject, are more or less filled with a water mucous froth, tinged sometimes with blood, as a result of the last violent efforts at respiration. Its presence in the air-passages does not depend on the fact of the person rising to the surface, although this may increase the quantity, but rather upon the *violent spasmodic efforts made to breathe in circumstances in* which water can enter the lungs, with or without air.

This presence of watery mucous froth in the air-passages may be regarded as the particular characteristic of asphyxia from drowning, and when discovered in any large quantity it furnishes a presumption of this mode of death. A specimen should always be examined by microscopy.

Mucus is a product of the lining membrane of the air-passages, and its secretion is a vital act. Hence we can easily understand that the longer life has continued, and the fiercer the struggle for it, the more likely there is to be a considerable proportion of mucus in the froth, and also the more likely to be *increased absorption of water. This view is precisely in accord with* the results of experimental drownings, and is probably correct. From a medico-legal point of view, this is a matter of no interest beyond the suggestion that little froth means rapid death.

In some cases regurgitated contents of the stomach may be found inhaled; this is apt to occur when a person has been drowned with a full stomach. A vomit reflex has been aroused by the effect of suboxia on the medullary centre, and gastric contents have been drawn into the lungs by attempts to breathe during the act of vomiting.

The sub-pleural hemorrhages (petechiæ) noticed under the heading of asphyxia, are seldom observed in drowning, but when present they offer corroborative evidence of this *form* of death. It is the extreme distention of the alveolar sacs that prevents interstitial venous engorgement—and therefor also petechiæ.

The Heart. The heart, in cases of drowning, has been found in varied conditions of fullness and emptiness on the two sides. Hence as evidence of the kind of death its condition is valueless. In the first place, the heart continues to beat some time after respiration has ceased, and therefore the condition might on this ground be simply that found in any form of death; this is variable. That the right ventricle is much weaker than the left would easily account for the fact that, though both may be empty, the right never contains less blood than the left; both contain suboxic blood which (*vide infra*) may provide useful information upon analysis.

The Brain. A pronounced fullness of the vessels of the *brain* has been described as one of the appearances met with in drowning; but this, when it exists, is probably a consequence of hypostasis, since the head tends to hang low in the water. Extravasations of the blood within the brain or on the surface of the brain is rarely seen in the drowned; and when it exists, may be assumed to be the result of mechanical violence before submersion, or of the head's contact, before death, with hard objects beneath the surface of the water.

The Stomach. In examining the abdomen, it will usually be found that the *stomach* contains water, which has been swallowed during the struggle

for life. This may be salt or fresh, clean or dirty, according to the medium in which the drowning has taken place. The quantity is subject to great variation: sometimes it is large, at other times small, and in some instances no water whatever is found.

Obolonsky made a number of experiments in order to show whether water could or could not enter the stomach after death, and he ultimately formed the conclusion that such entry was possible, but was extremely improbable under the ordinary conditions of drowning. It is, however, very important to note not only the actual quantity of any water found in the stomach, but also the presence of foreign substances such as portions of algæ, water weeds and mud. A specimen should always be taken and examined microscopically after centrifuging.

The Blood. The dark colour of the blood is accounted for by the absorption of all available oxygen, and consequent reduction of the hæmoglobin. A laking of the blood in fresh water and crenation of the red cells when drowning occurs in salt water may be observed as described later.

The fact that the heart continues to beat after the lungs have become waterlogged causes interesting alterations in the distribution of salts in the two sides of the heart and in the state of the red cells which are described later. (p. 481.)

The fluid, often tinged with hæmolysed blood, that is found in the pleural sacs in cases *not* recovered soon after death is a transudate through damaged visceral pleura.

Cases indicating the importance of autopsy occur in forensic practice with some frequency:—

Suspicion was aroused over the death of a woman of 46 found, according to her husband, a refugee from Europe, dead in her bath, face down. She was naked and the bath contained some 10 inches of cool, but not yet cold, water tinged with soap. Had it not been that neighbours had seen them quarrelling violently that morning no suspicion of foul play would have arisen. C.I.D. officers who were called found nothing to guide them: the dead woman still grasped a cake of soap in one hand and a flannel in another. Autopsy provided the solution: she had a hæmopericardium due to rupture of a several-day-old infarct of the left ventricle and had evidently collapsed whilst having her morning bath.

A small boy, about five years of age, was ordered to be placed in a warm bath for some little time. The nurse, who was holding him, was unfortunately called away. She was absent not more than two or three minutes, and on her return found the child dead beneath the water. Autopsy showed no trace of water in lungs or stomach. It was only on examining the left kidney that the cause of death (from shock) was explained; a large calculus which had shifted from the renal substance had suddenly blocked the ureter, no doubt causing such agony that the child had died immediately from reflex shock.

Proof of the Cause of Death

It will be necessary, now, to consider how far the appearances met with in the drowned are pathognomonic of this form of death. Among the **external signs** of drowning when the body is seen soon after death are the presence of watery mucous froth about the nostrils and lips, paleness of the surface, and a "pimpled" state of the skin (cutis anserina). The absence of these appearances, however, would not prove that the person had not been drowned; for if the body had remained some time in water, or if it had been long exposed to air before it was seen by a medical man, the skin may have undergone various changes in its condition, and mucus and froth might no longer be found adhering to the nostrils and lips. The size of the pupil is not helpful.

The "goose-skin", or *cutis anserina*, which is frequently observed in the drowned is not always present; and even when present it has no more value than has the fact that it is a common feature of bodies pulled out of the water. Cutis anserina changes are common to a number of other circumstances, and, indeed may occur in life.

Substances Grasped in the Hands. Foreign substances are sometimes found clenched in the hands, or caught under the nails of drowned persons. This fact may occasionally afford strong circumstantial evidence of the manner in which a person has died. If materials found grasped within the hands of the deceased have evidently been torn from the banks of a canal or river, or from the bottom of the water in which the body is found, we have strong presumptive evidence that the person died in the water. Although it is possible to imagine that the deceased may have struggled on the bank, and have been killed prior to submersion, we are assuming that there are neither marks of violence on the person nor any other appearances to suggest that death had occurred in any way other than by drowning. If the substance caught in the fingers or finger-nails is of the same nature as that at the bottom of the river or pond, or consists of portions of weeds growing there, it is difficult to think of any stronger evidence to establish the fact that death took place subsequently to submersion.

Occasionally two or three persons are drowned in the same accident; they are not infrequently found clasping each other—a fact which at once proves that they must have been living when submerged. So if a dead body is discovered still holding to a rope, cable, or oar, no further evidence is required to show that the deceased must have died in the water, provided that there is no other evidence forthcoming as to possible death before falling into the water and instantaneous rigor. Cadaveric spasm, with contraction of hands and feet, lasting till putrefaction sets in, is possibly more common in drowning than in other forms of violent death.

The **Internal** changes upon which we may chiefly rely for proof of *death from drowning* are—water with mucous froth in the air-passages and lungs, water in the stomach, and changes in the blood.

Water with Mucous Froth in the Air-passages. If the body is removed from the water with care, and is examined at a sufficiently early period, these appearances will furnish satisfactory evidence of death from drowning. The mucous watery froth is sometimes tinged with blood; its mode of production has been described above.

It must be remembered that froth at the nose and mouth and frothy fluid in the air-passages is found in deaths from other causes—for example, in those accompanied by acute œdema of the lung. On the other hand, its absence does not necessarily prove that a person has not died from drowning. A mucous froth may not be found when the body has remained for a long period in the water after death, since the froth, although formed in the first instance, may have become extruded. If, after removal from the water, the body lies for several days before being examined, it is highly unlikely that this appearance will be seen.

Foreign Bodies in the Lungs. Not only is water inhaled in drowning, but sand, mud, weeds, or other substances floating in it, are also carried into the air-tubes and spaces of the lungs. When the water is mixed with weeds or mud, and water presenting the same admixture is found in the gullet,

stomach and bronchial tree, this is strong evidence that the body has been plunged into the medium when the power of breathing and swallowing still existed.

When a dead body is thrown into the water, and has remained there some time, water, fine particles of sand, mud, weeds, etc., may pass through the windpipe into the large air-tubes. In these circumstances, however, water does not penetrate into the smaller bronchi and alveoli as it may by aspiration, and the amount which passes through the chink of the glottis is small. If simply an after-death effect, the water is found only in the larger air-tubes unaccompanied by mucous froth. In fresh cases, however, the effect of aspiration, as a result of living power, is so manifest that the examiner can have no difficulty in forming an opinion. There seems to be no very reliable experimental evidence to show that in any circumstances, even those of advanced decomposition, water with suspended matters can penetrate even to the distant air-tubes in anything more than the very smallest quantity, unless actively inhaled by respiratory efforts during life, and *à fortiori* none that such matters can penetrate to the spongy lung substance without similar aspiration.[1]

As in the case of the stomach, so with the lungs, it is the quality, or nature of the suspended matters that is of most critical importance of which the following case is an excellent example:—

Chevers was required to examine the body of a child found dead in a tank at a distance from the house of its parents. The internal appearances showed that the child had died from drowning. The air-passages contained green vegetable matter, and the right air-tube was almost completely filled with so large a portion of an aquatic weed doubled together, that it appeared astonishing how such a body could have passed into the windpipe. It was proved that no weed of this kind was growing in the tank in which the dead body was found; and further inquiry led to the discovery that the body of the boy had been found by a woman in a tank near his home, in which a weed like that taken from the air-passages grew abundantly. She had conveyed the corpse to the more distant tank, which belonged to a person against whom she bore a grudge.

The great cause of failure in obtaining medical proofs of drowning is generally the unavoidable delay before an inspection is made. It is most unsafe to assume that a body found in water has died of drowning; far better *to admit the uncertainty of the evidence.*

At an inquest, it appeared that the body had been three weeks in the water. One medical witness said that from the presence of water in the stomach, and the fluidity of the blood, his opinion was that the deceased had died from drowning. Another contended that, from the lungs being found in a collapsed state, death had not taken place from drowning. The jury could therefore come to no satisfactory verdict. No further evidence was adduced.

The proper course in such a case would have been to state that the changes which had taken place after death had rendered it impossible to form a sound opinion.

In *R. v. Kirwan*, difficulty arose owing to the length of time which had elapsed before the body of the deceased woman had been inspected. On the day following its removal from the water, the body was superficially examined *externally.* Thirty-one days after death, and 26 days after burial, it was exhumed, and a proper inspection made. The lungs were found engorged with blood, the heart empty, the stomach empty and contracted. The absence of the usual appearances found in recent cases of drowning was considered by some of the witnesses to prove that the woman had *not* died from drowning, but that she had died from some other cause, and that her body had been afterwards placed in the water. Considered apart from the non-medical evidence, the inspection of the body threw no light what ever upon

[1] Mueller, B., 1942. *Dtsch. z. ges. gerichtl. Med.,* 19, 488.

the cause of death. Medical evidence based upon appearances so long after death is untrustworthy.

The general impression among non-medical persons appears to be that, whether in drowning or suffocation, there ought to be some particular *visible change* in some parts of the body to indicate at once the cause of death; but this notion is founded on false premises. A medical inference of drowning is founded upon a certain series of facts, to each of which, individually, it may be easy to raise plausible objections; but taken together they furnish evidence of considerable strength.

Deaths from epilepsy and suffocation, which are interesting and instructive in this connection, are worth quoting:—

A man was in the act of leaving an outdoor closet when he was seized with an epileptic fit, and fell with his face in a pool of dirty water, which did not exceed a foot and a half in breadth, with a depth of from 3 to 4 inches. When discovered after death, only his mouth and nostrils and one cheek were found to have been under water.

A gentleman, aged 30, had retired to his dressing-room apparently in good health. Some time later, upon breaking open the door, his body was found lying dead in a sponge bath on his face, with the nose and mouth below the level of the water. Some time before he was thus discovered, a fall had been heard in his room, but no particular notice was taken of it. The body was inspected 24 hours afterwards. There was a recent wound of the skin of the right arm above the wrist, evidently caused by pieces of a washhand basin which had been broken. The *medical and other evidence showed that, although the body was found with the face under water, the deceased had not died from drowning,* but that he had been seized with a fit—probably epileptic; that he had fallen into the sponge bath, breaking the washhand basin in the fall, and thus producing the recent wound of the right arm. It transpired that he had previously had two epileptic fits.

The position may be thus summarized. If water similar to the water of the locality is found aspirated into the lungs, death was certainly due to drowning: the less evidence there is of this aspiration of water the more weight must be attributed to any other possible cause of death found: if there is *no evidence of aspiration of water* the person was not drowned, but died from something else which it may or may not be within the possibility of evidence to determine.

Water in the Stomach. In death from drowning a certain amount of both air and of water is swallowed. Experiments have repeatedly proved that if a dead body be placed in water with the mouth forcibly kept open, water does not enter the stomach. It has been suggested that water may be found in the stomach of a person apparently drowned in consequence of this liquid having been drunk by the deceased and it may be admitted that the deceased may have drunk water before his body was submerged; analysis and microscopy may differentiate the two.

The discovery of water in the stomach is not, therefore, necessarily proof that it has been swallowed during the act of drowning.

It must, of course, be shown that the liquid contained within the stomach is of the same nature as that in which the body is immersed, for it is possible that fresh water may be found in the stomach of a person drowned in salt water. If the water contains mud, straw, duckweed, moss, diatoms, or any substances like those existing in the pond or river where the drowning occurred this is a proof, when the inspection is recent, of its having been swallowed by a living person.

The absence of water from the stomach cannot, however, lead to the inference that the person had not died from drowning, because the victim may not happen to swallow. Its apparent absence should not excuse the failure to examine the stomach contents—for swallowed silt and biological matter.

Alterations in the Blood. The layers of vascular and alveolar epithelium in the lung may be regarded as a semi-permeable membrane, and when the alveolar spaces are filled with a drowning medium, the passage of fluid and electrolytes will occur. No doubt there are many factors which will determine the relative effects of endosmosis, exosmosis and imbibition in such circumstances, but the net results will tend towards producing an equilibrium in salt content between the blood in the lung capillaries and the water in the lung spaces. As the circulation is usually maintained for a short but appreciable time after the lungs are filled, changes might be expected more noticeably in the blood on the left side of the heart.

In drowning in sea water, the lungs are filled with a fluid of greater osmotic power than the blood. Osmotic exchange will result, therefore, in a relative increase in the electrolytes, particularly in the blood in the left side of the heart. In drowning in fresh water, the fluid in the lungs has a lower salt content than normal blood plasma, and the results of osmosis will be to produce a dilution of the electrolytes, that is to say, a relative diminution, again detectable to greatest degree on the left side of the heart. The effect of such changes on the red corpuscles will tend to cause crenation in the one case, and lysis in the other.

Gettler, found the chlorides raised on the left side of the heart when drowning was in salt water.[1] In the series of experiments by Jetter and Moritz,[2] the chloride and magnesium contents of the blood on both sides of the heart were found raised immediately after death from drowning in salt water, the increase being greater on the left side. After putrefaction had commenced, there was an increase in the magnesium in cases where, irrespective of drowning, the chloride content fell.

Although progressive loss of plasma chlorides is a normal *post-mortem* phenomenon, observations in a corresponding series of experimental drownings in fresh water showed a reduction in chlorides on both sides of the heart, within fifteen minutes of death, to levels not found in control animals till much later *in the post-mortem* period. Hæmolysis of the blood was a striking feature. Early estimations of the chlorides are obviously far more significant than those taken at later periods.

Examination of samples of blood collected separately from the right and left sides of the heart may thus be of value in determining whether death

[1] Gettler, A. O., 1921. *J. Amer. Med. Ass.*, 77, 1650.
[2] Jetter, W. W., and Moritz, A. R., 1940. *Arch. Path.*, 35, 601.

was due to drowning. It must be realized, however, that there are circumstances which may nullify the practical application of the tests indicated above. Significant changes in the blood are dependent on the circulation being maintained for an appreciable time after the lungs are filled with fluid, and this does not invariably happen.

The agonal and early *post-mortem* differences of significance tend to disappear as putrefaction progresses, and many cases are only brought to examination after putrefaction has become well advanced in the drowning medium. According to Moritz, the increase in magnesium referred to above occurs in the blood in 12–24 hours after death, irrespective of the cause of death.[1] This increase is indicative of the onset of putrefaction, and, in the presence of putrefaction, a diminution in plasma chlorides becomes less significant. It would seem advisable, therefore, to ascertain the magnesium level as well as that of the plasma chlorides, in order to provide a check on the significance of the latter figure, especially in cases of suspected drowning in fresh water. The same considerations do not apply to sea water, in which *the chloride and magnesium contents are approximately 5 and 44 times that of normal plasma.*

How Long has the Body been Dead?

The pathologist is quite frequently required to express an opinion on the length of time that may have elapsed since death from drowning. The rules which have been suggested for the guidance of a medical witness on these occasions (pp. 193 and 198 *et seq.*) are open to so many exceptions, owing to the different rates at which putrefaction takes place in bodies exposed in apparently similar circumstances, that they are of little service as a basis for medical evidence.

In a series of tests one of the authors made in the river Thames over the course of a year it was found that, though the estimated time of death would, in general, be near the facts (whenever they were established), it could never be certain of being so owing to:—

(*a*) The uncertainty of where the body had lain at the various times of its period of immersion. A difference of 9°C. had been noted in readings of water temperature taken from opposite shores of the river at the same level (owing to a soap and oil factory pouring out a hot discharge on one side).

(*b*) Mechanical pinning down or locking of the body for an unknown period. This might keep it down (and, therefore, cooler) and never exposed to air at low tide, decomposing very slowly.

(*c*) Uncertainty as to the precise state of the body on recovery. Changes take place with such rapidity on exposure to air after several days immersion that opinion is best based on the state *immediately upon recovery of the body.*

In general, the time of year was as good a guide as any. Bodies which had sunk came to the surface in London in some 36–48 hours in summer (June–August), after three to five days in spring and autumn (April–May and September–October), and in 10 to 14 days, or rather longer, in moderate English winter weather, (November–December). In January to February, when extremely cold, the body might not come up at all, decomposition being at a standstill, but it was likely to float in two to three weeks, often being recovered in shallow water.

The general *post-mortem* changes to be found in bodies immersed for periods

[1] Moritz, A. R., The Pathology of Trauma. 2nd, Ed., 1954, p. 190. London: H. Kimpton.

up to several months are described in detail in the section on *Post-mortem Changes* (see p. 163).

When does a dead body in water float? At the trial of Spencer Cowper for the alleged murder of Sarah Stout,[1] the buoyancy of the human body living and dead, formed an important part of the inquiry. But the medical facts in connection with putrefaction were then but little understood, and the evidence given was quite unreliable.

The specific gravity of the human body in the *living* healthy state is made up of the combined specific gravities of its different parts. In the first place about 73 per cent of the weight of the body consists of water—hence the question of specific gravity can refer only to the remaining 28 per cent of dry solids. The only part of the body which is lighter than water is fat. The specific gravity of this is 0·92, and it is calculated that the proportion of fat in an averagely built adult is about 5 per cent of the weight of the body. The specific gravity of muscle is 1·085, of brain 1·04, of the soft organs generally 1·03, of the lungs containing air 0·94, and of bone, the heaviest part of the body, 2·01. The lightness of the fat and the buoyancy of the lungs is more than counterbalanced by the weight of the skeleton (about ten and a half pounds in the male, and nine pounds in the female), so that the naked human body, placed on water, has a slight tendency to sink. An inexperienced person raises his arms continually out of the water, and as often sinks, owing to their "dead" weight. When the *whole* of the living body is immersed, the specific gravity, lowered by the expansion of the chest, differs so little from that of water that a very slight elevating motion of the hands or feet will suffice to keep a person on the surface. The head, owing to the weight of the bones of the skull, has always a tendency to sink below the rest of the body.

There are two circumstances which cause the specific gravity of the body to vary. If the quantity of *fat* is proportionately large, the specific gravity will be diminished, and such a person will float more readily than another of a leaner condition. On the other hand, a large proportion of *bone* renders a person heavier than his bulk of water; and his body will sink more rapidly than that of another. These two modifying causes of buoyancy are liable to variation. Women are, *cæteris paribus*, of lower specific gravity than men; the skeleton is smaller, and there is a greater proportion of fat—hence they more readily float. Infants and young children float more readily than adults; the quantity of fat is usually in large proportion, and the bones are relatively light. Thus, in infanticide by drowning, the body of a child that is not weighted rises very speedily to the surface; indeed, it commonly persists in remaining afloat.

The buoyancy of the body depends to a considerable extent on the condition of the lungs. If these organs are deflated then the specific gravity is considerably increased; a person with a large and capacious chest tends to float more easily than one whose chest is small. In a living person the body has a tendency to rise out of water during inspiration, and to sink during expiration, according to the quantity of water displaced. A fall into water with the chest nearly emptied as the result of a loud scream or shriek, is very unfavourable to floating, whereas drawing a deep breath assists flotation.

Clothing being on the person may also make a difference, either from its

[1] Lord Birkenhead, 1926, "Famous Trials of History", p. 89.

nature, in serving to buoy up the body, or from its weight to sink it more deeply. Women are sometimes saved from drowning because their clothing traps air or floats out to present a large surface to the water; their bodies often thereby remain floating on the water immediately after death—as happened in the case of Sarah Stout (*vide supra*). The specific gravity of sea water is 1·026, and as this differs but little from the specific gravity of the muscles and soft organs the human body floats much more readily in salt than in fresh water; indeed, except for the weight of the skeleton, it would have but a slight tendency to sink in the sea. A little trapped air in the clothing may prevent the body sinking.

The human body, when it rises to the surface from putrefaction, usually floats belly upwards. This is owing to the abundance of gas in the intestines and to the fact that the spinal column with its bones is heavier than the anterior wall of the abdomen, so that the trunk, unless anchored as it were by the hanging limbs, tends to assume a position in which the centre of gravity is as low as possible. There would seem to be no difference between a male and a female body in this respect.

It may be laid down as a general rule, that the recently *dead* unclothed body is *heavier* than water, and sinks when immersed. The expulsion of air from the lungs, their penetration by water, and the fact that the bones and all the soft parts excepting the fat, are of greater specific gravity than water, provide a sufficient explanation for this. After a variable period, according to the environmental temperature—the time of year—the body, if free to move, will rise again to the surface and float. The period of its rising will depend: (1) on the specific gravity of the body; (2) on the nature of the water, whether salt or fresh; (3) on the conditions facilitating putrefaction. If the gases generated find an escape, the body may again sink; more gases may form, and then it will again rise, so that the sinking and rising may become alternate phenomena. But some dead bodies whether death has been caused by drowning or not, may not sink at all, owing to some counteracting cause, whereas others—especially if weighted by apparatus, stones, heavy boots, etc.—may sink like a stone and never come up again until relieved of their anchoring weight.

Where a body sinks into infested waters or is attacked by fish or crabs it may become disintegrated before the conditions tending to promote floating are established.

Accident, Suicide or Homicide?

This question is more complicated in theory than in practice, for, as a rule there is a body of collateral evidence which, in itself, renders medical data of secondary importance. The subject must nevertheless receive earnest consideration.

Naturally, the actual fact of death from drowning has first to be established; this we have sufficiently discussed. A person may be suffocated, or may die from epilepsy, apoplexy, or from a sudden attack of any other fatal disease which may or may not be indicated by well-marked appearances after death; the body falls into water, and remains there a few days. When taken out, water may be found in the lungs, but there may be none in the stomach; there may be no mucous froth in the windpipe. In the case of a suffocated body, without marks of external violence, it would be impossible to determine whether death had actually taken place within the water or not, since persons may die in water or at the moment of immersion, in circumstances in which the

appearances of drowning would be either obscure or entirely wanting. Such cases have already been illustrated.

Again, if in examining a body taken from the water the pathologist finds disease sufficient to destroy life, there is a *prima facie* ground for inquiry. Suicides who have been driven to take their lives by intolerable pain or anxiety form a large proportion of such cases. It remains for the pathologist to assure himself that drowning did, in fact, cause death.

There is of course, no reason why an adult should not be standing close to the water and fall in when seized with a disabling attack of disease. The following cases well illustrate the value of medical evidence in certain cases.

A man of 40, inmate of a mental colony in Essex, was found dead in the grounds of the institution, the face in a large pool of water which, at its deepest was a mere 1¼ inches. He was dead and the signs of drowning were fairly well marked: silted matter identical with that on the path where he lay was found in a sample of fluid taken from the mid bronchial tree. He was a known epileptic, and seemed likely to have collapsed and drowned, in the puddle in which his body was found.

An infant found dead in the toilet of a hospital, head down, was at first assumed to have died of attention following birth into the lavatory pan. A sample of the bronchial tree fluid, however, showed *lysol* and soap to be present—substances *not* in the sample taken as routine from the pan where the body lay. A nurse subsequently admitted drowning the child in a wash basin (which had contained lysol) in her room. There had been nothing, apart from analysis, to arouse any doubt as to the authenticity of her first story of birth into the lavatory pan water.

In *R. v. Griffin*, a woman was charged with the murder of her child by drowning it. She alleged that it was dead when thrown in the water. The lungs were found to be congested and contained mucous froth, which was also found in the windpipe mixed with sand, particles of which were seen in the smaller air-tubes. The lungs were fully distended. The heart contained on the right side fluid blood; the cavities on the left side were empty. All the organs were healthy. The appearances were only consistent with death from drowning. The judge asked the medical witness whether he was not influenced in forming his opinion by the fact that the body of the child had been found on the bank of a river. The witness said that he would have come to the same conclusion, even if he had not known of that circumstance. He was perfectly justified in that view by the appearances, since there is no disease affecting children which will produce them. If the child had had convulsions, it had been exposed while living to the action of water. The woman was convicted.

An inquest was held on the body of a gardener who was drowned in a brook. There were less than 6 inches of water in the stream. The man's face was on the mud at the bottom, and his hair was frozen. It was stated that his father *committed suicide by hanging*. The jury returned a verdict of accidental death.

A man was found dead with his face in some melted snow, and there were several severe contusions on his body. The evidence showed that, after a quarrel, he had left a neighbouring inn much intoxicated; and it was evidently highly probable that he had perished accidentally on his way home. There was no reason to suspect foul play.

A woman was charged with causing the death of a child by drowning it. The child was found dead, with its face in a basin of dirty water. The woman had placed the child in this position, and had then locked the door. *The death of a child in these circumstances is, however, quite compatible with accident.*

A medical man was called to a child of 18 months, which he found dead: the skin was cold, and a frothy mucus, tinged with blood, was escaping from the mouth and nostrils. The tongue was swollen and protruded. The mother of the infant, a respectable woman, gave the following account:—She was washing in one room while the child was in an adjoining room, the door between the rooms being kept open by a pail half full of water. She went out of the house for about two minutes, and *on her return she found the child with its head downwards in the pail of water*, the legs and part of the body hanging over the side of the pail. She snatched it out and tried to revive it, but without avail. There was no reason to doubt the truth of her statement, and at the inquest, the jury returned a verdict of accidental death.

A man was found dead in a water-cistern in his house. He was partly dressed; his head was downwards in the water, and his feet resting on the edge of the cistern. It was supposed that in reaching forward to the tap, he had lost his balance and *fallen with his head first into the water, and was unable to extricate himself.* The facts seemed to point to accident, though suicide was, as always in such cases, *a* possibility.

In the case of *R. v. Smith*, known as "the brides in the bath case," no less than three women were murdered by drowning in a bath. The murderer in each case had immersed the victim by lifting the legs up and pushing the head under water. In only one of the cases was there any signs of violence—that of Miss Lofty, in which there were three bruises on the arm. Suspicion was only aroused by the chance reading in a newspaper of what seemed a curiously repetitive series of "accidents" involving the same man.[1]

A medical witness must not allow himself to be deceived respecting the cause of death on finding that the *whole* of the body had not been immersed, or that the clothes are not wet. In drowning in shallow water, only the face and the hair of the head may present the appearance of wetness, and some water, with or without foreign matter, may be found in the nostrils, throat, and bronchial tree.

Marks of Violence. The greatest attention must be given to marks of violence, whether external or internal. The violence may have been so great or so vital as to account for death if inflicted on the living; on the other hand, the injuries may be slight, but of a significant character. *R. v. Carnt* is particularly instructive in this respect, as the marks on the body of the victim were very slight, and it required great acumen to interpret them correctly.

The body was removed after it had been lying about four hours in the water, and was carefully examined 41 hours after death. The right eye was ecchymosed, the pupils slightly dilated, the lips bluish, and there were bluish patches on the face. *Slight scratches were visible on the right side of the face.* The nails were filled with sand and mud. *There were severe bruises on both arms near the elbow, as from gripping hands.* The tongue was greatly congested, and covered with froth and mud, which extended backwards to the throat and nostrils, as well as into the larynx and windpipe, and the upper divisions of the bronchi. The lungs were engorged and

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[1] The Trial of *George Joseph Smith*. Notable Trials Series. London. Wm. Hodge & Co.

greatly distended: when cut in any part, frothy bloodstained mucus poured out, and a watery liquid escaped on pressure. There were small pieces of green weed in the air-tubes, corresponding to weed in the pond. The vessels of the neck were distended with dark-coloured liquid blood. The stomach contained partially digested food, with "about a pint of liquid mixed with mud and sand".

An opinion, which was perfectly justified by these appearances, that the deceased had died from drowning, and that she had probably been held forcibly under water was confirmed by a confession of the accused, after conviction.

In the same connection the following cases are also instructive:—

In an accident, a man and his wife were thrown into the water by the over-turning of a small boat. The woman was drowned. On examination of her body, a livid circle was found round her neck, as if she had been strangled, but no ligature to account for it. She had evidently died by drowning, and the mark on the neck had been produced by the string of a cloak which she wore at the time of the accident. In her struggles to reach the boat, it is presumed that the tide had drifted the cloak in an opposite direction, and had thus produced the usual appearance of violent strangulation. It is not improbable, however, that the constriction accelerated death.

Circumstances, as matters of proof, do not always present themselves, or come to mind, at the time when observation of them would be of the greatest assistance to the court. Irrespective of grounds for suspicion, the most trivial observations must be assessed with great care.

In a case of murder, in which the body of the deceased was discovered in a mill-stream, there was only one slight ecchymosed depression in the fore part of the neck, as if from a finger. The doctor suspected from this that the deceased had been strangled by the pressure of a hand on the neck. The marks of drowning in the body were wanting, and the medical suspicion of the real cause of death was afterwards confirmed in a confession by accused.

The chief problem is whether injury has resulted from accident or from design, and in forming an opinion, the doctor must give due weight to the accidents to which a body floating loosely in water may be exposed. Surface injuries of considerable extent are sometimes seen on the body when it has been carried by a current against mechanical obstacles in a river or canal. Many abra-sions are not visible immediately after the removal of the body from the water, especially if sought within a few minutes of death. Lacerations may be produced by the body being rubbed against rocks or sea gear by the move-ment of the tide. If the deceased fell from a considerable height into the water, his body in falling might have struck against a rock or projection, and thus have sustained extensive violence. A dead body taken out of a well often presents considerable marks of violence whether the deceased has fallen in accidentally, has been thrown in, or has thrown himself in inten-tionally. The presence of these marks should not lead to a hasty suspicion of murder. It is manifestly impossible to lay down any specific rules for coming to a decision in cases of this kind.

but on the last occasion he sank and was drowned. Both his arms were found dislocated at the shoulder-joints, in consequence, it would seem, of his having fallen with his arms in the horizontal position, instead of placing them closely to his sides. The force of impact of the arms on falling into the water had sufficed to produce the accident—proof that even the mechanical resistance offered by water alone may give rise to violent injury to the person.

Chevers examined the body of a sailor who fell into the water with his head downwards; and it was found on inspection that there was an extravasation of blood in the head beneath the arachnoid membrane, and there was every reason to believe that extravasation had been produced by the fall.

Fractures may be accidental, as in diving into shallow water and striking a hard substance. Except in such circumstances, fractures are most often met with in the drowned as the result of accident or by tearing injuries from passing craft, after death.

In *R. v. McKinstry* (C.C.C., 1942), a soldier was convicted of the murder of a girl by manual strangulation on Waterloo Bridge. The body had been found lying on the foreshore in the early morning after the night on which she had been murdered, and the right leg was fractured. The police surgeon assumed she had hit a pier in the gravel foreshore in jumping to take her life from the bridge (then in the course of construction and deserted at night). Autopsy disclosed that she had been strangled: the fracture had been sustained "at or about the time of death", and could have resulted from her body hitting a pier—but not the gravel foreshore, no comparable impressions being present on the skin.

In *R. v. Kettleband*, where the prisoner was charged with the murder of a boy aged ten years, the deceased was found dead in a pond. At the inquest, no inspection of the body was required by the coroner, and the jury were directed to return a verdict of "Found drowned". An inspection was, however, made subsequently. The neck was observed to be very loose, and on further examination, the tooth-like process of the second vertebra of the neck was found to be separated from the first (the atlas), through rupture of the ligaments. Three medical witnesses who gave evidence at the trial deposed that this displacement had caused death by compressing the spinal cord, that the injury had occurred during life, and that it was not likely to have been caused by accident from a fall into the water, as there was no mark of a bruise about the head, and the pond was small, with a soft muddy bottom. All agreed that such an injury was not likely to have arisen from a blow or a fall in any circumstances, but it required for its production that the body should be fixed, and the head forcibly rotated on the trunk. It was in itself sufficient to account for immediate death, and it could not occur by accident after death from any other cause. *Circumstances pointed to the guilt of the prisoner, and the jury returned a verdict of manslaughter.*

Fracture-dislocations of the cervical vertebræ can occur from accident at about the time of drowning, and we may therefore expect to see both injury *and* the signs of drowning, the former constituting a disablement leading to the latter.

A boy of 17, diving from the springboard, was seen to go deep into the 8 ft. end of a swimming bath. He lay still on the bottom, and it was "several minutes before people realised something was wrong". On recovering his body froth water poured from the mouth and efforts at revival were of no avail. Autopsy showed he had a rounded bruise of the centre brow, and a fracture-dislocation of the cervical spine at C.3/4 which had crushed the cord. His death had, nevertheless, been precipitated by drowning.

A man threw himself into a river to bathe from a height of 7 or 8 feet, the water being only 3 feet deep. He rose to the surface, but fell back insensible. When he recovered consciousness, he said that he felt his hands touch the bottom of the river, but to save his head, drew it violently back, upon which he lost consciousness. He died in about ten hours, and on examination, the skin of the back of the neck was ecchymosed, the interspaces of the muscles were engorged, and the spinal canal was filled with blood. The body of the fifth vertebra of the neck was broken across

about the middle of its depth, and the two pieces were completely separated from the lateral parts.

Such injuries may occur accidentally in cases in which one might not expect them. They should be sought for as a routine procedure.

Incised or Lacerated Wounds may give rise to grave suspicion. The principal questions to be determined in such cases are: (1) Were the wounds sustained before or after death? (2) Could they have been self-inflicted? These questions have been fully discussed (*vide* p. 225), but it must be noted that cases where suicides have cut their throats deeply just before throwing themselves into deep water are not rare. As in all other cases of this nature, it is obvious that the longer the body has been in the water before inspection, the less easy will it be for the medical man to give definite evidence as to the timing and precise nature of the injury.

The bites inflicted by Fishes, Rats, Molluscs, etc., on a body in the water are generally fairly easy to distinguish. The edges of the raw surface are more eroded than ragged or sloughy; there may be the actual marks of the teeth, or possibly even shell-fish *in situ;* but no doubt cases of great difficulty in this respect may arise, especially if the creatures attacked the spot where an open wound gave them easy access to the flesh; this will in general tend more to obliterate homicidal or suicidal wounds than to exclude the action of animals.

Inasmuch as suicide may be attempted by more than one method, it is by no means rare to find poison in the stomach of those drowned. Stevenson met with a case in which there was every reason to believe that the man had taken a fatal dose of aconitine, and then had swum out to sea, where he was drowned; on the other hand, Tidy quotes a case where a woman administered arsenic to a friend, and upon finding its action too slow for her liking, pushed her victim into the water. Whereas the finding of poison in the stomach of a drowned person may not afford proof in any direction, it requires explanation; as a rule it is strongly suggestive of suicide.

Firearm Wounds in the body of a drowned person may be homicidal or suicidal. They will require the same examination as if no question of drowning had arisen.

Ligatures on the Body. In considering the inferences to be drawn from the presence of ligatures or binding ties on a body taken from the water, it is of great importance to determine in the first place whether death was caused by drowning or not. The presence of ligatures appears to the lay eye to offer strong *prima facie* evidence of homicide; but numerous cases are recorded in which suicides have tied their limbs together before throwing themselves into water, probably to ensure that no change of mind can influence their fate.

The nature of the evidence to be given will obviously depend upon the position, the tightness and the nature of the ligatures, as well as the position of the knots (*vide* "Strangulation", *infra*). If the limbs only are tied, an effort should be made to ascertain whether they are tied in a way in which the victim could have tied them himself. Complete reliance must not be placed upon evidence of this nature, for a cunning murderer might succeed in deceiving experienced observers. The presence of a ligature, almost certainly precludes the possibility of accident. Circumstantial evidence will often remove any element of doubt concerning ties round a body.

Weights attached to Body. If a body is taken out of water with heavy weights attached to it, the question of accident does not arise. It must be either homicide or suicide, and whereas with infants or children one may reasonably suspect murder, instances in which persons have committed suicide by drowning, with heavy weights attached to their feet and hands, or in or about the clothing are common. Much the same remarks apply here as in the case of ligatures above; the nature of the weights, how they are attached to the body, i.e., by ligature or fixed in the clothing; all such findings, if properly interpreted, may throw much light on the case. The circumstantial evidence may, again, be of great importance.

Age has some bearing on the question of accident, suicide or homicide, and also on suicide or homicide. Drowning in infancy is commonly homicidal. The earliest age at which a person is reported to have committed suicide by drowning is that a boy of seven, whereas accidental drowning is common enough in childhood and the teens. The question whether the victim can swim is, of course, most important of all non-medical queries: a surprisingly large number of adults whose livelihood is gained on the river or sea have never troubled to learn to swim.

STRANGULATION

Definition

In strangulation, asphyxia may be induced not only by the *constriction* caused by a ligature round the neck, but by the simple application of *pressure* (throttling), through the fingers or otherwise, on the voice-box and glottis, the windpipe—or, it must be said also, on the great vessels of the neck. Strangling (called throttling, when effected by the hands) is asphyxiation by mechanical constriction of, or pressure upon, the neck by some means other than the weight of the victim's body.

many cases of sudden pressure upon the neck. When it is pronounced the signs and symptoms of classical asphyxiation do not have time to develop; when it is absent they are pronounced.

Arterial compression is not easy to effect—or to diagnose after the event, but if closure of the great vessels results, loss of consciousness is likely to occur rapidly without producing signs of asphyxia. The coarse grades of change are:—

Form	*Symptoms and Signs*
(a) Vagal inhibition alone.	Sudden loss of consciousness and arrest of respiration and pulse. No autopsy features.
(b) Slight vagal effect— some venous constriction.	Buzzing in ears, congestion and cyanosis in head, vertigo, tingling, muscle weakness. Slight asphyxial autopsy features.
(c) Pronounced venous constriction. Some respiratory obstruction (arterial compression reduces degree of change).	Same symptoms. Slower loss of consciousness. Colour changes in head and neck more marked; bulging eyes and ecchymosis of conjunctivæ—occasional petechiæ.
(d) Extreme venous and respiratory obstruction—arterial compression lessening degree.	Rapid development of discoloured (cyanosed) face and neck above constriction. Bulging tongue and eyes, tinged (blood shot) eyes with many petechiæ in scalp, eyelids, conjunctivæ, etc.

It is, in fact, the *localization* of these features of acute mechanical asphyxiation that may, as we have suggested above, be sufficient to arouse strong suspicion of strangulation in the absence of some local mark on the neck. Their occurrence above a line on the neck suggests constriction possibly by a ligature, but as something of a line of constriction can be effected between the thumb and index finger, local finger tip marks—or nail scratches must be searched for with great care.

Post-mortem Appearances in the Strangled

These may usefully be divided into—the general external appearances; the injuries found on dissection of the neck; and the general internal appearances.

may have escaped from the nose and mouth, occasionally the ears, in surprisingly large quantity. It is often mixed with mucus and saliva, thinned by œdema fluid from the lungs.

In *R.* v. *Millas*, the prisoner had murdered one Huelin and his housekeeper. After having packed the body of the housekeeper in a box, he requested a carrier to place a cord around the box. *The carrier observed that fluid blood was oozing* from the box, and that there was a large stain of blood on the floor beneath. When the box was opened, the body of the woman was found inside. There was a cord tightly tied around the neck, and blood which had escaped from the mouth and nose had run down the side of the box. The woman had been strangled, and such force had been used in the tightening of the cord around the neck as to lead to an unusually pronounced turgidity of the head and neck, and unusually copious bleeding.

One of the authors examined a case at Canning Town, East London, in which a woman of 72 had been found in a first floor living room dead, face down on a pillow on the floor. A rope encircled her neck tightly, having been wound round 18 *times*, with the loose ends coming down on each side of the neck to lie over the front of the cheek. She had died of asphyxia. Her husband was gravely ill in hospital and she had threatened to commit suicide. There was no cause for suspicion of foul play. (See Fig. 55.)

Fig. 55. Self-inflicted strangulation by a ligature wound around the neck 18 times, tightly but without knot or other tie. (See text *supra*).

Bleeding from the ears, as a result of rupture of vessels of the tympanum, must, however, be regarded as an exceptional appearance. The general lividity of the body, with the clenching of the hands and swelling and protrusion of the tongue between the lips, are generally more marked in strangulation than in hanging. The involuntary discharge of fæces, urine, and seminal fluid, described as one of the features of death by asphyxiation often occurs in death from strangulation. Nevertheless importance can be attached

to this as an isolated sign of death from asphyxia. It frequently occurs in sudden and violent death from any causes, and there are many instances of death from asphyxia in which it is not observed.

Dissection of the Neck. In the act of strangulation by the hands a much greater degree of violence is commonly employed than is necessary to cause death; finger nail impressions are common, and if much force has been used locally in producing the constriction, the larynx, windpipe, with the muscles, even vessels in the front and sides of the neck, may be found bruised or lacerated. The hyoid bone is sometimes fractured,[1] the thyroid cornua commonly so, their alae infrequently.

In a series of 24 cases of manual strangulation, Gonzales found fractures in 13, distributed as follows: lateral thyroid ala, 3; arch of cricoid, 2; cricoid and thyroid, 3; superior cornu of thyroid, 1; hyoid, 4.[2]

The mark on the neck when the ligature has been used, is commonly a linear depression, corresponding in its characters to the form and thickness of the ligature and the mode in which it has been secured. Too much importance must not be attached to this supposed correspondence when the ligature is not forthcoming. The mark around the neck may present the appearance to be expected from the use of a narrow cord, when, in fact, a soft silk handkerchief was the means of constriction; a narrowness of the mark in parts may be due to folding of the ligature. The mark or impression produced by a ligature is generally circular, from the mode in which the pressure is produced. It may be situated at any part of the neck, but it is more commonly about the middle, across the thyroid cartilages of the larynx, contrasting with the position above the larynx in hanging. In manual strangulation the marks of bruising and ecchymosis will be on the front or sides of the neck, chiefly about the larynx and above it. Marks of pressure of fingers may, however, be slight.

In *R. v. Loughans* (Winchester Assizes, 1943 and C.C.C., 1944), the victim showed finger marks on the throat to the left of the midline at the level of the hyoid bone and body of the thyroid, the thumb mark under the angle of the right lower jaw. They were not particularly well marked and there were no nail impressions immediately related to them. Upon the arrest of Loughans it was found that *he had lost the greater part of the distal two phalanges of the index to little fingers of his right hand*. It had no finger nails. It had, however, sufficient span to match the marks on the neck. For reasons unconnected with this medical evidence a jury failed to agree at the Winchester Assizes, and at re-trial at the Old Bailey found accused "Not Guilty". The case was one of considerable interest.[3]

A medical witness ought to weigh all the facts connected with the position of the body, and the nature and direction of the ligature, before he forms an opinion, from the appearances presented by the mark on the neck, whether the person has been strangled or not.

In *R. v. Ley* and *Smith*—The Chalk Pit Case[4] (C.C.C., 1947) the body of a man had been found dead in a shallow pit freshly dug on a hillside in Surrey. Coils of rope lay loosely round the body and there was no indication how they had come to lie so, though they raised strong suspicion of foul play. A mark on the neck, however, suggested that deceased had been suspended in a noose that encircled his neck. It transpired that he had been waylaid and bound in the basement of a Kensington house. Exactly how he met his death has never been discovered but death was definitely due to a felonious act.

Greater importance is to be attached to the asphyxial changes and abrasion of the skin in the course of the ligature than to the circularity or obliquity of the depression produced by it. When a living person is strangled by means of a cord, it is scarcely possible to avoid producing on the neck marks of severe injury, the existence of which indicates the violent manner in which death was caused. In the dead, the clothing or the folds of the skin may both leave creases of livid staining across the neck.

On the other hand, a person may be strangled, and yet the ligature, in consequence of its being soft and of a yielding nature, may not cause a perceptible mark—scarcely anything more than a slight depression or flush of the skin. Such a condition must be rare, because assailants usually inflict a much more violent constriction of the neck than is necessary to ensure the death of a person.

Fracture of the hyoid or thyroid bone is extremely rare in cases of strangulation by a broad ligature, for the pressure is too widely distributed; it is throttling fingers that fracture the thyroid or hyoid.

In a case examined by one of the authors the hyoid (R. ala), both alae and both superior cornua of the thyroid and the ring of the cricoid were crushed, bone breaking through into the interior of the larynx, and causing asphyxia owing to bleeding after the grip had been released.

In R. v. O'Brien, a case alleged murder by strangulation, the cartilage of the windpipe was broken. Fractures are, of course, more likely in the less elastic, calcified cartilage of the elderly.

General Internal Appearances. *The Lungs.* These organs show variable changes. Intense venous congestion, with numerous petechial hæmorrhages and numerous spots and patches where vessels have given way, are found in the majority of cases. In addition, froth, more or less bloodstained, will be found in the bronchi. Though this is the usual picture, cases in which death occurs with great rapidity do not show the same degree of congestion. It must be recognized that, though affording strong presumption of asphyxia, these changes, *seen alone*, are not pathognomonic. [1]

Microscopic sections show areas of hæmorrhage into the interstices, under the pleuræ and through ruptures of the alveolar walls. In some places there is over distention and in others, collapse.

The heart presents no uniform condition, but the right side is usually full of dark fluid blood. Subepicardial petechiæ are not uncommon. *The brain* is usually congested and may show petechiæ in the white matter. Blood is effused over the brain, under the arachnoid, more commonly in newly born children (*vide* "Infanticide").

The abdominal viscera, liver, kidneys, spleen, etc., are usually deeply congested, and, in young persons, the mesenteries or bowel may show petechial hæmorrhages.

Proof of the Cause of Death

The general features of asphyxial death found in strangled bodies have been noted above, viz., intense venous congestion in general, capillary stasis, hæmorrhages into the substance of the lung and into mucous membranes, punctate petechiæ in the skin and conjunctivæ, prominence of the eyes, protrusion of the tongue, or its pressure against the teeth, and bloody froth and mucus in the trachea. Circulation ceases with life, so it is utterly impossible that a ligature placed round the neck after death could produce

[1] Gordon, I, and Turner, R., 1951. *Arch. Path.*, 52, 160.

these appearances: the presence of these signs strongly suggests that death was due to asphyxia. Nevertheless they are not in themselves pathognomonic, for, as Gordon and Turner have insisted, they occur in other suboxic deaths. Their *local* distribution in the head and neck is, however, strongly presumptive of strangling.

Evidence of **violent compression or constriction of the neck** during life is obtained from the presence of ecchymoses about the marks on the neck, hæmorrhages above the level of the constriction, and swelling and lividity of the face. These are phenomena which cannot be simulated in a dead body by the application of any degree of violence. When the constriction is produced within a few minutes after death, a depression results, but it is highly unlikely that there will be any lividity or swelling of the tissues above. The experiments of Casper showed the impossibility of producing on a dead body anything at all resembling an *ante-mortem* strangulation mark.

.In the absence of ecchymosis in the neck, it will be difficult to form an opinion, unless from circumstantial evidence. It must be remembered, however, that there may not always be any well defined marks, for a person may be strangled by the application of pressure to the neck through some soft medium. In the absence of all marks of violence round the neck, we should be cautious in giving an opinion which may affect the life of an accused party, for it is difficult for homicidal strangulation to be accomplished without the production of some appearances of violence on the skin. It is doubtful whether strangulation ever takes place without some marks being found on the neck indicative of the means used, but there is a remote possibility that death could be caused in this manner, without leaving any appreciable trace of violence. Suicides and murderers generally employ much more violence than is necessary for the purpose of taking life. If a soft and elastic band were applied to the neck with gradually increased force, it might be possible that death from strangulation would result without there being any external *sign indicating the cause of death*. Thugs, and other Indian robbers, were thus accustomed to kill their victims with great dexterity.

One must be prepared to consider whether, in the absence of any mark, death might not have resulted from another cause of suboxia. There is nothing to justify a witness in stating that death has resulted from strangulation if there should be no local asphyxial changes or marks of violence about the neck or face of the deceased. The state of the countenance alone will not warrant the expression of an opinion, for there are many kinds of death in which the features may become livid and shot with petechiæ from causes totally unconnected with the application of external violence to the throat.

of discolouration or signs of asphyxia are relied upon as evidence of homicide, there is a great risk of a serious mistake.

The body of a man, recovered from the Thames after five to eight days' immersion, had already become very discoloured and partly bloated when put out for autopsy. A pronounced linear band stood out round the neck, pale and less decomposed than adjoining skin, and the head and neck above this was turgid, almost black. The mark was undoubtedly merely a collar mark, and the local colour change in the head and neck due partly to constriction by this—but mostly to it hanging lower in the water after death.

In cases of alleged drowning it is sometimes the practice to ask a medical witness how far his opinion of the cause of death has been influenced by the discovery of the dead body in or near the water. In cases of alleged strangulation, a similar question may be put in reference to the discovery of a rope or ligature around the neck of the deceased, or in the room in which the dead body is found. A medical opinion should rest upon the clear and obvious effects produced on the neck and structures below the skin, and not upon the mere presence of a cord or ligature. This might, for a malicious purpose have been put around the neck of a dead body or near it. A medical witness should be able to prove the fact of strangulation without the production of a rope as easily as the fact of stabbing without the production of the weapon used by the assailant.

In *R. v. Sinclair* (Maidstone Assizes, 1916), a old Polish woman refugee had been found strangled behind a hedge on Wrotham Hill in Kent. There was no ligature round the neck, but there was a broad flush and dried cuticle abrasion marks of a scarf or some piece of cloth across the front of the neck. There were autopsy signs of asphyxiation by strangling, many petechiae being present over both lungs. Sinclair when arrested at first denied, but later admitted strangling the woman—*with his vest.*

The ligature or cord should always be examined for the presence of blood, hair, or other suspicious substances.

Accident, Suicide or Homicide?

Accidental Strangulation. As a general rule, cases of accidental strangulation present no difficulty to a medical jurist, provided the relations of the body to surrounding objects and the constricting agent have not been disturbed. Should the body have been removed from the place in which it was first discovered, or the ligature have been removed, we can only establish a presumption of accident from the description given. Accidental strangulation, like accidental hanging, is not rare, though less frequent than inadvertent hanging.

In one such case, the subject was a boy, who was accustomed to move about with a heavy weight suspended by a string round his neck. One day he was found dead in a chair: the weight appeared to have slipped, and to have drawn the cord tightly round the fore part of his neck.

A girl was accidentally strangled in carrying fish in a basket on her back, supported by a leathern strap passing round the front of her neck, above her shoulders. She was found dead, sitting on a stone wall; the basket had slipped off, probably while she was resting, and had thus raised the strap, which had firmly compressed the windpipe.

In a similar case, a boy, aged 14, while working in a factory, was caught by a silk necktie in the band on an engine, and his neck was by this drawn down against one of the revolving shafts. The silk handkerchief being knotted and tightly twisted round his neck, his throat was firmly compressed for about one minute. The tie was then cut. As a result of the strangulation, he became black in the face, and blood escaped from his mouth and ears. He was insensible for

six or seven minutes after the ligature had been removed. He then revived and was able to speak, but could not hold up his head.· He was sensible when brought to the hospital soon afterwards: his face was pale, his lips livid, his eyes suffused, and the conjuctivæ injected. He breathed without difficulty, and complained of pain only when he moved his head. There was a deep circular depression round his neck over the windpipe, and the skin was much abraded and bruised. The mark was about threequarters of an inch in width on the left side. The circumference of the neck was 12 inches, while the inner circumference of the handkerchief which compressed the neck was only 8 inches. The boy at the time of the accident felt no pain: he had a sense of choking, and then became insensible. He recovered, and left the hospital in about 18 days.

When a charge of murder by strangulation is brought, an attempt is not infrequently made to show the probability that the deceased, while in a state of intoxication, might have fallen, and have become accidentally strangled, either by a tight scarf, or collar and tie. When there is pressure on the windpipe, a person will usually make frantic efforts to free his neck, and thus may inflict injuries on his throat which may lead to a suspicion of throttling.

A well-to-do bachelor went to bed at 1 a.m. after having dined well. At 7.45 when the valet called him he lay dead in bed on his back, deeply engorged in the head and neck above the line of his collar and tie which, according to the valet, were "extremely tight". Excess mucus (but no vomit) lay at the back of the throat and in the glottis, and the trachea and bronchial tree were filled with œdema fluid: the lungs were profoundly engorged, cyanosed and œdematous, with occasional petechiæ. He had died of slow strangulation, aided by engorgement, mucus and œdema fluid accumulation and circulatory (suboxic) failure. The blood alcohol at his death was 210 mg%.

The umbilical cord may be so twisted around a new-born baby's neck as to cause accidental strangulation. If such a case aroused suspicion of homicide, marks of violence would be the chief evidence, as accidental strangulation by this means leaves no bruises or other marks except possibly a slightly indented line of pressure by the soft cord. (See Vol. II.)

Suicide or Homicide? There is as a rule less difficulty in answering this question in cases of strangulation than in alleged hanging, owing to the greater difficulty of a murderer being able to simulate a suicide. For all that, it may now and again be very difficult to decide, and we must consider the various points that may help us in forming an opinion.

> Inherent possibility of suicide.
> Bodily infirmity as an obstacle.
> Is there any other cause of death?
> Marks of violence elsewhere than on the neck.
> Signs of a struggle.
> Marks on the neck.
> Nature of the ligature and its method of application.
> Position of the body.
> Circumstantial evidence.
> Cases of homicidal strangulation.
> Alleged strangulation.

relax. When a person, determined on suicide, allows the windpipe to be compressed by leaning with the whole weight of his body on a cord passed round his neck and attached to a fixed point, he may die in this manner almost as readily as if he had hanged himself; for insensibility and death will soon supervene.

Similarly a cord may be tied around the neck and twisted tightly by means of a stick used as a lever. We have examined a case of suicide in which a cord was wound several times around the neck and finally tied.

Fig. 56. Strangling by ligature. Horizontal tie of ligature encircling neck in homicidal strangling effected from behind, the victim being pinned face down on the ground. A part of the frock and some hair are caught in the tie.

Bodily Infirmity as an Obstacle to Suicide. There may be disease, such as paralysis or deformity in one or both of the arms, which may render it impossible for a person to tie a ligature around his own neck. The only caution here to be emphasised is that we do not push this doctrine of incapability too far. When there is a fixed resolution, many apparent impossibilities may be overcome by a person bent on suicide. The following case is instructive:—

A middle-aged woman was brought into the Hotel Dieu, suffering from insanity. She had lost, by amputation, *four fingers of her right hand. Soon after her admission* she killed herself by strangulation. The nurse, in going round the ward, saw her lying at the side of the bed with her head hanging out. She was dead, and that there was a silk handkerchief carried twice around the neck and then tied in front. The eyes and eyelids were very reddened and swollen. The marks of the ligature around the neck were deep, ecchymosed and partially excoriated.

The significant feature of this case, in which there could be no doubt of suicidal strangulation, was that deceased had lost four fingers of her right hand; nevertheless, she managed to tie the handkerchief around her neck with great firmness. If her body had been found in a suspicious place, a plausible opinion of homicidal strangulation might have arisen because of the maimed condition of the hand. A case such as this serves to convey a proper caution in drawing inferences as to acts which a person suffering from some bodily infirmity are capable of performing when he makes an attempt on his own life.

Is there any other Cause of Death? All marks of violence on the body of a supposedly strangled person should be studied with care, as the facts

respecting them, however slight, are material. A medical witness should be able to state whether they were inflicted before or after death; if before, whether they could be related to death, or whether they were such as to be explicable on other grounds. It should be observed whether there was any disease sufficient to account for death, as this kind of evidence may be vital. In the case of females, whether children or adults, the pathologist should not neglect to examine the sexual organs, so as to ascertain whether there are any marks of violation or signs of pregnancy. Cases in which rape has been perpetrated and strangulation resorted to for the purpose of stifling cries, or in accomplishing the criminal act are common enough:—

During the second world war, the authors saw a number of cases of rape and strangulation in varying circumstances, of which the following are examples:—

Two American soldiers were convicted under U.S.A. Military Law of the murder of a local girl at Ashford, Kent. Each had raped her in turn as she lay pinned on the grass at a cricket pitch, one holding her down across the shoulders and stifling her cries with the hand whilst the other effected intercourse. Sexual injury was not extensive, but scattered bruises were present on the legs and arms, on the inner aspects of the lips and on each side of the throat, due to pressure of the hands and fingers of an assailant, and corroborating the charge of rape.

In R. v. Leckey (C.C.C., 1943), the body of a cinema usherette of 18 was found in a blitzed shop at Folkestone; she had been the subject of a forcible sexual intercourse and had been strangled. Six black pubic hairs, presumably of the assailant, were found in the region of the vulva. The backs of her hands and one finger nail had been grazed and torn, and the neck bore marks of a grip being effected from both in front and behind. The face lay on the left arm when the body was found. A rounded bruise lay over the left wing of the thyroid (with a curved finger nail impression adjacent) and two similar bruises lay over the right wing at about the same level, set close together. A left hand applied from in front, or a right hand (with the thumb shifting its place once) was held to account for this mark. The larynx was fractured at the root of the left superior cornu and there was bruising behind it, between it and the spine. Behind the neck, a single bruise lay to the left of the midline near the hair margin, and three similar bruises with cuticular grazes as from finger nails lay to the right of the midline at about the same level—as from the pressure of a right hand from behind. The conviction of Leckey at the Central Criminal Court was reversed upon appeal owing to a misdirection by the Judge in his summing-up.

based upon the existence of marks or appearances found on a dead body, care should be taken to ascertain that such marks or appearances were caused only by violence. Even if marks indicative of strangulation are discovered, the question arises whether they may not have been produced upon himself by the deceased in an attempt at suicide. If the body of a dead person is allowed to cool with a handkerchief, band, or tightly fitting collar round the neck, a mark resembling that of strangulation may be produced.

Signs of a Struggle, etc. In directing attention to the circumstantial evidence, it may be suggested that *the clothing of the deceased being torn or disarranged*, is an indication that a struggle has taken place, and highly indicative against suicide. Evidence of murder may be obtained by finding *a smooth and undisturbed state of the clothing*, as well as attitude of the body. In fact, whoever attempts to simulate suicide under such a form of murder generally fails in his object. The assassin either does too little, or he does too much.

The woman who committed murder by strangling in Pinckard's case had been a nurse in an infirmary, and was accustomed to lay out dead bodies. After the murder she appears, unthinkingly, to have acted in accordance with her professional practice, by smoothing the clothes under the body, placing the legs at full length, the arms out straight by the side, and the hands open and laid out. Such a condition of the body was quite inconsistent with suicide, in view of the amount of violence which must have attended the act of strangulation.

In the case of Drory, the criminal had attempted to make the case look like a *suicide by placing the lower end of the rope near the hand of the deceased:* but he selected the *left* hand, whereas the deceased was right-handed, and he did not leave enough rope free from the neck for either hand to grasp in order to produce the violent constriction of the neck caused by the two inner coils.

In both of these cases an admission of guilt was made before execution.

Whereas suicidal strangulation may occur under unexpected circumstances, in a case of murder by strangulation it would not be easy to simulate suicide. It would at any rate require great skill and premeditation on the part of a murderer so to dispose the body of his victim, or to place it in such a relation to surrounding objects, as to cause real suspicion of suicide.

Homicidal strangulation may be perpetrated on infants and on the weak and infirm without causing any noise or creating alarm. In the first place, if the throat is at once seized and firmly compressed, no cry can be made, nor any noise produced to attract the attention of those who are near. The occurrence of vagal inhibition may increase the possibility.

An aged woman was strangled in her shop by an apprentice in so short a time and with such ease that her husband, who was separated from her only by a slight partition, heard no noise or disturbance during the murder.

In *R. v. Rourke* (C.C.C., 1934), a man laid hands on the neck of his wife who had just abused him for treading on her toes. "She just went limp" and he failed to rouse her. She had died virtually instantly.

Marks on the Neck. *Finger-nails.* In cases where the marks of fingers or finger-nails are present, the presumption must be of homicide; there must be the strongest presumptive evidence of murder, for neither accident nor suicide can afford a satisfactory explanation of such marks.

Such marks may sometimes be alleged to be due to a fall by the deceased while his hand was passively applied to his neck, the marks being accidentally caused by the pressure of his own fingers. This is a highly improbable mode

of accounting for the production of such marks. A person might at first try to strangle himself with his fingers. and upon failure, might afterwards use a cord. But the *degree to which the coincidental impressions exist will* usually remove all doubts. A murder committed in the manner mentioned was exposed with little difficulty:

A man was found strangled on board a ship. Besides the mark of a rope drawn tightly around the neck, there were distinct impressions of nails and fingers in front of the throat. An investigation took place, and the result proved—as, indeed, this state of the neck rendered it almost certain—that the deceased had been murdered. One of the murderers afterwards confessed that they had first strangled him with their hands, and then had drawn the rope about his neck, to make sure that he died.

Finger-nail marks might be self-inflicted in a struggle, which again suggests homicide.

Fractures of Larynx and Deep Bruising. In homicidal strangulation, from the unnecessary violence used, we may expect to find the skin grazed and the tissues bruised, the deep-seated parts, such as the muscles and vessels, more or less bruised or lacerated. The hyoid bone, larynx or trachea may show signs of pressure against the spine, or may have been fractured.

In the following case, the marks of injury to the neck clearly established homicidal strangulation:—

In *R.* v. *Casey* (C.C.C., 1943), a soldier walking down a hill in Putney dragged a woman passer-by (who proved to be a stranger to him) into the front garden of an adjacent house, to get astride her and strangle her with both hands. He was disturbed by an air raid warden who called a passing police patrol: the victim was breathing as the P.C. reached her, but died after a few gasping breaths. The neck was unusually heavily injured, the hyoid (right wing), thyroid (both alæ and all four cornua) and cricoid ring being fractured. *The alæ of the thyroid and the* cricoid ring had been thrust through the mucous membrane of the larynx, lacerating it and causing both extensive submucous hæmatomata and bleeding into the trachea and bronchial tree. The retro-thyroid connective tissues were also extensively bruised where the whole voice box had been crushed and rolled against the spine.

In *R.* v. *Waller*,[1] a medical man was throttled by three men, one of whom placed his left hand over the mouth of his victim, and with the right compressed the throat. When found within five minutes of the attack, the deceased was alive, but died almost immediately after. *Post-mortem* examination showed only a slight mark on the neck, crescentic in form, with the concavity upwards, a little to the right of the midline, and just below the cricoid. It appeared as if made by a thumb- or finger-nail. There were no other indications of violence. The scalp showed numerous minute ecchymoses, and the features were of a livid hue. There was much blood extravasated over the larynx and trachea. The hyoid bone was fractured on the right, close behind the lesser cornu. The thyroid cartilage was fractured vertically from the notch backwards and downwards to the lower border, the right cornu was fractured, and there was a nearly similar fracture on the left. The cricoid cartilage was also broken.

untenable. The body of the deceased did not weigh probably less than 120 pounds, whereas the tape found around her neck broke under a weight of 49 pounds; hence the deceased could not have been freely suspended by it. Apart from this, the injuries to the parts about the neck, including the longitudinal fracture of the windpipe, were not such as the tape could have produced as a result of partial suspension in the position in which the deceased's body was found. *The deceased had been strangled.* These facts, taken in connection with the smooth arrangement of the clothes, the severe marks of violence on the body (inexplicable on the hypothesis of suicide), and the marks of blood and of struggling in the room, *proved that there had been homicide;* and the crime was brought home to the prisoner by circumstantial evidence inconsistent with her innocence.

False marks on neck. A caution must be given to be sure that the mark *is* that of a cord. On the dead bodies of infants and children, in whom the neck is short, marks are occasionally seen which arise from the folds in the skin due to bending of the head; and in short-necked persons, a similar mark or depression is often found after death, across front of the neck. *If the collar band of the shirt is tight it may produce a line of pressure which may engender suspicion.* These marks are rendered more prominent by livid staining. They might, at first, be mistaken for marks produced by a ligature in attempted strangulation.

Mark in a Burnt Body. The mark on the neck has furnished evidence of this mode of death, even in circumstances in which it might be supposed all evidence would be destroyed. Schuppel describes a case in which he was able to verify the fact of strangulation after the burning of the body.

A fire took place in a cottage in which there were at the time a man and his wife with a stepson (aged ten) and a new-born infant. The dead bodies of his wife and stepson were discovered much burnt, and the carbonised remains were collected and buried in one coffin. A suspicion of incendiarism and murder arose, and the bodies were exhumed 13 days after the burial, and submitted to examination by Schuppel. The body of the wife was so completely destroyed by fire that no satisfactory medical evidence could be obtained from it. The parts not entirely burnt were much putrefied in both corpses. On examining the burnt remains of the boy, there was a horizontal mark or depression encircling the greater part of the neck, about one-quarter of an inch wide, and presenting a smooth surface quite distinct from the broken, blistered and carbonised skin above and below it. The width of the mark in the middle of the neck (the nape) where it was most superficial, was about a quarter of an inch; on each side of the neck where the pressure had been greatest, it was three-fifths of an inch. The skull was fractured and the tongue protruded remarkably from the mouth, but these changes could have been due to the heat of the fire.

Schuppel drew the conclusion that the boy had died from strangulation, and that the ligature had been applied to the neck while he was living, and had been burnt with the body. The man accused of this double crime alleged in defence that a beam might have fallen and produced the mark observed on the neck; but this would not explain the facts. He was found guilty of the murder of his wife and stepson.

Nature of the Ligature and its Method of Application. In all cases of fatal strangulation resulting from an act of suicide, the means by which strangulation was produced must be found upon the neck. The condition of the mark on the neck, the course and direction of the cord, the way in which it was secured or fixed in order to produce effective pressure on the windpipe, the amount of injury to the muscles and parts beneath, are circumstances from which, if observed at the time, a correct medical opinion may generally be formed.

If the means of constriction are removed, or the cord or ligature is loosely

applied, these facts, unless explained, are presumptive of homicide. Thus, if the cord or ligature should be found loose or detached—if the ecchymosis or mark in the neck should not accurately correspond—if, moreover, the means of constriction were not evident when the body was first discovered, there would be fair grounds for presuming that the act was homicidal.

. If the ligature is still around the neck, the position of the knot may throw some light upon the case; if tied in two or three knots at the back of the neck, the presumption is in favour of homicide. The nature of the ligature is of little importance. Both suicides and murderers generally employ for ligatures those articles of clothing which are nearest at hand—such as belts or ties, stockings, or scarves. The ownership of these may sometimes become an important clue to crime. Twine or rope are common alternatives.

In all cases the ligature should be examined in order to determine whether it bears upon it marks of blood, or whether hair or other substances are adhering to it. It should be reserved for purposes of identification. In some cases of homicidal strangulation. the ligature found around the dead body may be proved to correspond with parts of the same material found in the possession of the person who was charged with the murder. In removing the ligature from the neck, the way in which it is secured should be left intact, for this may be of importance in reference to the allegation of suicide.

A young woman was found dead in bed, lying on her face, with a woollen garter passed twice round her neck, and secured in front by two simple knots, strongly tied one on the other. The body was in an incipient state of putrefaction but still there was a mark corresponding to the ligature. This was shallow, of a slight greenish colour, especially in front, and presented here and there ecchymosed spots; the mark was scarcely visible behind. The face was livid and swollen; a quantity of bloody mucus escaped from the mouth and nostrils. The lips were livid; the tongue was protruded and firmly compressed between the teeth: the body presented over the trunk and limbs patches of ecchymosis. On cutting into the mark on the neck there were no extravasation, neither was there any apparent injury to the deep-seated muscles or adjacent parts; the lungs were engorged with blood, but the other viscera presented no significant appearance.

The medical examiners judged from the condition of the face that apoplexy was the cause of death. There was some reason to suppose foul play and a person was indeed suspect, but medical investigation, relative to the state of the body and clothing, as well as numerous collateral circumstances, satisfactorily established that this was a case of suicide.

The dead body of a woman, aged 40, was found strangled. Her husband had left her, at 8 a.m., in a nervous, depressed condition. On his return to dinner at midday, he discovered her stretched at full length upon the bed with some thin twine twisted around her neck, and fastened to the iron rails at the head of the bedstead. She was "black in the face", and lying about 2 feet down the bed. He at once cut the string from her throat, and ran for a medical man, who, on his arrival, found that the woman had not been long dead. The body was straight, but the features were much distorted. She appeared to have struggled, but the bed-clothes were smooth, and so were her own clothes. The case was clearly one of suicidal strangulation. The woman had previously been confined in a mental hospital.

method adopted. The ligature which he used was found tightened around his neck by means of a stick, which had been twisted and then fixed behind one ear; there was no lividity of the face. It was alleged that Napoleon I. had caused the General to be strangled or suffocated, and that the ligature had been applied afterwards. The evidence that this was an act of homicide was very weak, and, having regard to the medical evidence, there is no reason to doubt that it was an act of suicide. We have seen an identical case in a suicide over which no doubt could arise.[1]

There are, however, cases on record, in which a suspicion of suicide might not easily be entertained. One of these, involving coiling a rope round the neck, has been described above. (*Vide* Fig. 492.)

In the following case there was evidence of design, and also evidence that no other person could have been near at the time, so that suicide was certain.

An inquest was held on the body of a man, aged 40, who was found lying dead on the floor of his room dressed only in his undervest. Around his neck was an ordinary piece of string, which he had tightened by passing the handle of an umbrella through the loop and twisting it around at the back of his head. A verdict of suicide during temporary insanity was recorded.

In *R. v. Drory* the body of a young woman was found lying upon the face, strangled, with a rope coiled three times around the lower part of her neck. The two inner coils (involving the windpipe) were tight, the outer coil loose, the end of the cord being placed loosely near the left hand of the deceased, which was raised towards it. The length of the free portion of cord was not sufficient to allow of the deceased grasping and tightening it to such a degree as to produce the great amount of violence found on the neck. The windpipe was flattened and its canal completely obstructed by the pressure of the two inner coils of rope.

Pressure on the windpipe, *sufficient to flatten it*, frequently produces instantaneous insensibility and loss of power. The evidence, medical and circumstantial, clearly proved the guilt of the prisoner, and he was convicted.

Self-applied ties are not always suicidal; it is not uncommon for experimental trussing, part of a masochistic act, to end fatally. The matter is referred to below.

Circumstantial Evidence.

In contested forms of strangulation, the court must be greatly influenced by evidence as to the circumstances as well as by medical presumptions. How far a medical witness is allowed to make use of these factors in the formation of an opinion it will be for the court to determine. Generally speaking, his duty is strictly confined to the furnishing of evidence of medical facts alone. But there are numerous circumstances of a collateral nature which may materially modify an opinion. Thus the nature of a ligature, the state of the clothes, and the posture of the deceased when found, although not strictly medical circumstances, bear directly upon medical opinions. Without circumstantial evidence, the best medical opinion in these cases will often amount to nothing. It is a mistake to suppose that in all cases the court must have regard to medical circumstances *alone* for clearing up intricate questions. On some occasions the conflicting theories of homicide *or* of suicide will be equally consistent with the facts. This was the position in the Chalk-Pit case (*R. v. Ley and Smith*, C.C.C. 1947), *vide infra.*

The following case was pronounced to be a case of *suicidal* strangulation owing to lack of evidence to the contrary—a dangerous mode of reasoning. A servant girl was found dead in her bed. The body was lying with the face turned to the right, and there was a handkerchief so firmly tied around the neck that it was with some difficulty removed. A quantity of froth and bloody mucus escaped from the mouth

[1] Simpson, Keith, 1953. *Forensic Medicine.* Ed. Arnold & Co., London.

and nostrils. The knot in the handkerchief which was tied around the neck was on the *left side*; the deceased was not left handed, and there was no reason to suspect that she had intended to commit suicide; she went to bed the night before in her usual health and spirits. There was no other mark of violence externally. The tongue projected between the teeth, but was uninjured. The lungs were engorged with blood. The act was not suicidal, according to the doctors making the examination, for the handkerchief was tied on the neck in *two knots*, and deceased could not,, they felt, have tied more than one; her senses would have failed her before she could have made a second, or at least before she could have made it so securely as the first. The position in which the body was found, the conduct of the deceased before her death, and the absence of all motive, were facts also adverse to suicide;˙ but as no evidence to the contrary arose, it was accepted that the act was suicidal.

Sometimes circumstantial evidence is almost the only ground for a suggestion either of suicide or of homicide: time, place, locked doors, fastened windows, motives, etc., etc., are all important factors.

In *R.* v. *Ley* and *Smith*, the "Chalkpit" case (C.C.C., 1947), a man's body had been found in a shallow trench high up on a hillside in Surrey. It had, evidence showed subsequently, been taken there by car from a basement flat in Kensington where, on the instruction of Ley, the victim was trussed by ropes and had a blanket thrown over his head. A rope mark ran round the neck, being sloped up under the left ear in such a way as to show that either the rope had been lifted and thus tightened, or that the body had slumped thus causing tightening of the rope. Neither police enquiries nor evidence at the trial revealed what exactly did happen. Nevertheless a conviction for murder followed, the Lord Goddard (L.C.J.) pointing out to the jury that, in law, the precise mode of asphyxiation did not matter, if the trussing was part of a criminal assault.[1]

the judge was his refusal to open the door when the neighbour knocked at it, shook it, and tried to open it. The evidence of the doctor contradicted his story of his wife having fallen into the fender; such a fall would not have caused the injuries found.

Strangling in Masochism. A form of death probably accidental in most cases is that in which adolescent boys—rarely adult men—meet their death from strangulation or hanging (*vide* p. 508) whilst indulging in tying themselves up, and other masochistic practices. These deaths are usually asphyxial eventually but the asphyxial features may become superimposed on a primary vagal inhibition. It is this vagal reflex which may put the victim into great danger by inhibiting his power to free himself. *Consciousness is apt to be rapidly lost and death occurs from asphyxia.*

A young man of 22 was found perched on the edge of a lavatory seat held in position by a rope suspended from the inlet pipe to the cistern above his head: the noose was slip knotted. A group of front page nudes from picture newspapers lay spread in a half ring on the floor in front of him, and the penis lay on the seat turgid, dribbling seminal fluid. Slight asphyxial changes were present and it was, therefore, assumed that vagal inhibition had contributed substantially to both collapse and death. The latter was recorded at inquest as "accidental".

In some of these, an element of sex, usually masturbatory, enters, but this adds nothing to the mechanism of death. It is, as Stearns[1] has pointed out, a reflection of a disturbance of mind of which this form of experimentation is but a facet. He described 25 cases of unintentional death from hanging, strangulation or suffocation in boys aged between 11 and 20, *in all of which there were pronounced masochistic circumstances.*

Alleged Strangulation. A living person may charge another with attempted murder by strangulation in which case a medical witness may be called to give evidence. An impostor rarely causes such injury to himself as to place his life in jeopardy. The cord is loose around the neck; *it is not secured so as to press with great force on the air-passages, or to cause the tongue to protrude, or to produce lividity of the face or neck, or ecchymoses in the conjunctivæ and the skin.* An impostor uses either a ligature or a rope; he does not usually resort to manual violence to his throat. One feature of a homicidal attempt is the *considerable amount of violence applied to the neck;* the account given by the impostor will be inconsistent in its details, and the findings irreconcilable with the more usual effects of homicidal strangulation.

A French merchant was charged by his servant, Roux, with having attempted to murder him by strangulation. The case ended in acquittal of the accused. At eight o'clock in the evening, Roux, a man in the prime of life, and the servant of the accused, was found in a cellar of his master's house, stretched on the floor, his feet and hands tied; he was apparently strangled, and it was said, almost lifeless. Under medical care, in less than three hours, however, he completely recovered. On the next morning (as he professed to be unable to speak) he informed those about him, by signs, that his master came upon him unexpectedly while he was in the cellar, scolded him, struck him a severe blow on the nape of the neck (which knocked him down), attempted to strangle him, and then bound him with cords, and left him on the floor as he was found. The injuries, according to him, were inflicted at half-past eight in the morning, so that on his own statement he had been lying on the cellar floor, in a helpless state and unable to give an alarm for more than eleven hours. The merchant denied the charge, and alleged that the whole statement was a falsehood. The charge, of course, rested simply on the word of one man against that of another. From Roux's position in the household, it was very easy for him to procure from his master's wardrobe the handkerchief with which the legs had been tied. Around the neck a cord was coiled three or four times, and was not secured by a knot. There was no injury to the skin, and there were no marks

[1] Stearns, II. W., 1953. *J. Maine Med. Ass.,* 44, 16.

on the neck such as the coils of this cord would have produced. The cords bound around the legs and wrists could have been applied by Roux himself; there was no swelling around them, so it was obvious that they could not have been applied for upwards of eleven hours, as stated. Although Roux stated that he was *rendered* insensible by a blow, yet he was able to observe and to describe minutely the proceedings of the merchant as to the subsequent strangling, and the binding of his legs and arms. No injury was done to the larynx; yet he professed to be unable to speak. It is highly probable that a short time before he was discovered he himself had arranged the whole thing. Accused was acquitted and discharged.

It is obvious that circumstantial evidence must play a great part in establishing or rebutting a charge of this kind.

HANGING

In hanging, the body is wholly or partially suspended by the neck so that the constricting force applied to the neck is the weight of the body acting upon the ligature is used as its means of support. It differs from strangulation in that, in the latter, the neck is constricted irrespective of any effect caused by the weight of the body.

Symptoms and Signs of Hanging

In addition to the general features of suboxia induced by mechanical means, which were described in the beginning of the section on Asphyxial Deaths (see p. 457), hanging is accompanied by certain special features. These are of great medico-legal interest, because they throw light on the cause of death in this form of violence, and also explain how easy it is for accidental and suicidal hanging to occur.

We learn from those who have been resuscitated, as well as from experiments performed by persons upon themselves, that in death from hanging, insensibility may take place in the most insidious manner, and that a slight constriction of the throat can speedily produce loss of consciousness. Suboxia may play little or no part in deaths from hanging. The only symptoms of which hanged persons have been conscious were a ringing in the ears, a flash of light before the eyes, then darkness and oblivion. The only useful inference which can be drawn from observations of this kind is that insensibility may not only be rapidly induced, but also that it may supervene in circumstances where it would not generally be expected to occur—i.e., when the body is in great part supported.

feet and spread over the body; vision partly disappeared, but there was no appearance of coloured lights. The head felt likely to burst, and there was a roaring in the ears; consciousness continued, and he could tell *his friend whether he suffered pain* from the knife-thrusts being made into his hand. In one minute and twenty seconds from the commencement, all sensibility ceased. In another experiment he became insensible in 55 seconds. A knife-thrust, sufficient to draw blood, caused no sensation whatever.

What has been said of masochism as contributing to sudden loss of consciousness and death from asphyxiation by strangling might equally be said of hanging; indeed, such accidents are more common to hanging than strangling because the former is the more common form of masochistic exercise. We have seen a number of such cases in which adolescent boys have been found dead in a toilet cubicle, or in other circumstances which permit secrecy.

Persons have undoubtedly lost their lives by privately attempting these experiments, and their cases have been recorded as acts of suicide. Boys have thus unintentionally killed themselves, from the desire to enjoy the thrill of being in danger, of suffering the agonal sensations they have read of in adventure tales—forms of masochism.

A boy, aged 14, witnessed an execution at Nottingham, and he was *afterwards* heard to say that he would like to know how hanging felt. On the same afternoon he was found suspended by a cord from a tree, dead; and from the circumstances there could be no doubt that he had been experimenting in his boyish way, on the theory and practice of hanging, and that he did not intend to kill himself. The jury returned a verdict of "Accidental hanging."

Dr. A. K. Mant describes a case of a boy of 21 found dead in Wormley Wood, Surrey, about one month after he had last been seen alive, hanging by thick rubber tubing which encircled the neck and was counter-poised by means of an attached clothes line weighted by a heavy breeze block. The trunk and legs lay resting on the ground but the neck was raised to a height of some 15 inches and held at this level by the weight. The body was dressed in woman's clothing—a tartan skirt, slip, knickers and padded brassiere. Both hands lay over the front of the genitals and resting on a book on sex perversions in women. An ejaculation of semen had taken place. There could be no doubt that death had taken place during the course of a masochistic exercise. (See Fig. 57.)

It is seen from the above facts that a person who is in danger of death from hanging may have no time to extricate himself from the noose, even if he should wish to do so. The rapid loss of consciousness in these cases is remarkable, and is due to a combination of effects from pressure on the carotid sinus, the vagus nerve and the greater vessels. The air passages matter little in such sudden losses of consciousness.

Causes of Death in Hanging

From the great differences in the autopsy appearances of those who have died from hanging, it is obvious that the actual cause of death is not always the same. There are undoubtedly at least four or five factors which might precipitate death, but experience has to some extent emphasized the *post-mortem* appearances of the common cause of death, viz., asphyxiation, which may be associated with varying instead of uniform results—according to the predominance of one or other factor. Death may take place from:

Simple blocking of the air-passages (asphyxia).

Congestion of venous blood in the brain by pressure on the jugular veins (congestive suboxia).

Obstruction to arterial flow to the brain by pressure on the carotid arteries (acute arterial suboxia).

Vagal inhibition from pressure on the vagus nerves, or carotid sinus (vaso-vagal inhibition).

Injury to the spinal column and the cord.

Combinations of any of the above.

Simple Blocking of the Air-passages. Both experiments and observation on persons hanged have shown that this is very easily brought about, its occurrence depending on the position of the ligature above or below the larynx and upon the degree of force used. Maschka found the ligature above the larynx in no less than 149 cases out of 153, and this is to be expected since a rope slips up until the jaw holds it. The pressure of the ligature com-

Fig. 57. Accidental death during masochistic exercise involving suspension by noose of cord looped around neck, slung over branch of tree and counterpoised by stone weight. (*vide* p. 509). (*Courtesy of Chief Constable, Surrey*).

presses the tissues of the neck and forces the base of the tongue against the posterior wall of the pharynx. When the air-passages are thus blocked, asphyxia must naturally be the prominent cause of death and with autopsy appearances that are indicative of profound *general* suboxia.

Venous Congestion of Head and Neck. When a ligature is tightened round the neck the principal venous trunks undoubtedly become somewhat compressed and as they form the main channels for the return of blood from the brain, congestion and stasis in the venous circulation in the brain is likely to be produced. From clinical experience we know that such a condition may cause unconsciousness, and it may take a share in the production of death in hanging.

A boy of four and a quarter years was left playing in a yard at the back of the house at 3.20 p.m. whilst the mother busied herself with housework. At 3.30 p.m. she happened to go to an outdoor lavatory where she found the boy hanging with his feet off the ground by a rope attached to the handle (3 ft. 4 ins. from the ground). A loop encircled the neck and was twisted above the head, and it appeared that the boy may have been playing with his head thrust into the noose, swinging out on the door over a step down to the garden—which added another 8 inches to the height of the handle from the ground; this was sufficient to carry the feet off the ground when the door swung open. Well marked asphyxial changes were present externally above the line of the noose encircling the neck and internally—in the pial vessels and the substance of the brain in particular.

Actual extravasation of blood from the intracranial vessels from this cause is not common; the state of unconsciousness seems to be produced by the suboxia so rapidly developed in the brain.

It is in these conditions that most pronounced *local* suboxic changes become developed: the head and neck become intensely engorged above the level of constriction and showers of petechiæ break out in the scalp, conjunctivæ, mucous membranes (nose and mouth), brain, and occasionally ear membranes.

Anæmia of the Brain. Constriction of the neck by the ligature tends to compress the carotid arteries, and this factor no doubt contributes to the rapid loss of consciousness observed in hanging. In violent hanging (judicial or homicidal) we have seen the carotid arteries rupture their inner coats—or occasionally tear.

Physiologists are now quite agreed that the brain cannot survive total obstruction of its blood arterial supply or venous removal for more than four or five seconds without serious derangement and loss of function. But the vulnerability of its component cells ranges from several seconds to as long as 30 minutes.[1]

Reflex vagal inhibition, from pressure on the vagal sheath or carotid bodies has already been described as a cause of sudden collapse—or of collapse and death in strangling. Even stretching of the neck may initiate this reflex, for similar receptor bodies lie over the arch of the aorta. Vagal inhibition is, *it seems, more likely to operate when there is sudden pressure or constriction* than when the weight of the body is taken up slowly.

When vagal inhibition plays the deciding role in the causation of death, the features of asphyxiation will not be established, for death will occur too rapidly for suboxia to develop. The amount of pressure may be remarkably little: Burstein and his colleagues have shown[2] that the stimulus required to produce a minimal fall of blood pressure in the abdomen was sufficient to cause immediate cardiac arrest when applied to the neck.

Injury to the Spinal Column and Cord. This can only take place when the hanging may be described as violent. Suicides occasionally drop into the noose but more commonly lower themselves into it; it may be said generally to occur only in judicial hanging. We have found the ligaments between the vertebræ of the neck ruptured only once in 52 suicidal cases.

Judicial Hanging. In executions instantaneous death is sought, and this is now always attained by means of a drop graduated in length inversely to the weight of the criminal. The drop is usually some 6–7 feet, the "final" measurement being some 2–2½ inches over the "initial" owing to fracture separation of the spinal cord, usually at C 2/3 or 3 4.

[1] Heymans, C., and Bouckaert, J. J., 1935. *C. R. Soc. Biol., Paris*, 119, 324.
[2] Burstein, C. L., Martin, S. J., and Rovenstine, E. A., 1949. *Anesthesiology*, 10, 133.

It is often said that after judicial hanging the body undergoes convulsive movements. These movements can by no stretch of the imagination be taken as indicating consciousness or knowledge on the part of the person hanged; they are merely the movements of a decerebrate subject. It is true that persons who have broken their necks may not only remain conscious but even recover; but the injuries are very different from judicial hanging, in which, by the drop, such violent extension is applied to the cord as to cause rupture of the cervical cord and instant unconsciousness and death. *Post-mortem* reports on judicial executions usually include a statement to the effect that the neck was broken and death instantaneous; the injury to the spine does not always take place at the same point; fracture-dislocations at the level of the 2nd/3rd or 3rd/4th vertebræ are common and fractures of the first and second vertebræ rare. The cord usually tears away at its junction with the medulla.

Combinations of the above. The findings in autopsies on persons who have been found hanged warrant the following conclusions:

1. Given pressure both on the air-tubes and blood vessels, the pressure on the air-tubes being only partial, death will probably result from a combination of obstructive asphyxia and interference with the cerebral circulation, but primarily from asphyxia. 2. Given pressure in such a position that the airway is more or less protected, death may occur from interference with the cerebral circulation, and will then be *slow*. The features of suboxia will not be so pronounced generally. 3. Given complete constriction, so that the entrance of air into the lungs is entirely prevented, death will result from intense asphyxia, and may be extremely rapid, but never so sudden as where there is sudden local pressure on the vagus sheaths or carotid bodies—when, death being due to reflex vagal inhibition, there will be no abnormal findings whatsoever.

Delayed Deaths

It by no means follows that, because one has succeeded in restoring breathing, a person is safe. Death often takes place at various periods after the incident.

Many such cases are reported up to as long as 20 hours after being cut down, and a consideration of the above causes of death in the light of modern physiology and clinical experience affords an explanation. Œdema of the lungs following on such a profound disturbance of the circulation through them is common. Œdema of the larynx may ensue and lead to rapid death after a certain period. Cerebral and meningeal congestion may cause a disturbance of function or frank softening, with petechiæ sufficient to cause death at some more remote period of time, sometimes by indirect means.

Time Required

The arguments advanced in the case of strangulation (see p. 461) apply almost without exception to hanging: we shall not repeat them here. We may, nevertheless, draw attention again to the risks of sudden death during masochistic and other hanging "experiments" (*vide* p. 508).

Post-mortem Appearances in the Hanged

These may be divided into three groups:—

The general external appearances.
The general internal appearances.
The special examination of the neck.

General External Appearances. These vary greatly according to the mode of dying. There may be lividity and swelling of the face, with protruding eyes and tongue, petechiæ in profusion in the head and neck and firmly clenched hands with purple nails. More commonly the face is pale and placid, protrusion of tongue and eyes is slight, but the lips are commonly blue or livid. Saliva may be noticed to have dribbled from the mouth, but this depends to some extent on the position of the knot in the ligature. If it is on the side, it tilts the head to the other side, and allows saliva to escape; if the knot is under the chin, it is unlikely that any saliva will dribble out. The secretion of saliva is a vital act, and its presence in sufficient quantity to run down over the chin and clothes is strongly indicative of suspension during life, or at any rate immediately after death, for the secretion ceases after cessation of the circulation. It must be remembered that the pressure of the rope on the salivary glands may have some effect on this secretion. A state of erection or semi-erection of the genital organs which has also been frequently noted, with or without expulsion of semen, has no reference to the precise nature of the death. *Post-mortem* lividity is most marked in the legs, and occasionally a number of ecchymoses may be seen on the skin of dependant arms or legs as well as above the line of constriction of the neck. *Taking the general external appearances as a whole, while they may suggest a mechanical asphyxial death, there is commonly nothing about them to suggest such a thing with the exception of the position of the body in its relation to the head, which is most important.* The early or late appearance of rigor mortis is quite immaterial, but if the head is found hanging over at an angle it proves that the hanging took place before rigor mortis set in or after, it had disappeared from the neck. The mark of constriction is usually visible, often very clearly so. (See below.)

General Internal Appearances. Autopsy usually reveals the appearances described under "Asphyxia", i.e., engorgement of the lungs, heart and venous system generally with dark-coloured blood. Subpleural petechiæ are frequently seen but they are not common over the heart. A fine bloody mucous froth, due to imperfectly obstructed respiration, with increasing suboxia of the lungs, is quite common. The right side of the heart, and the great vessels connected with it, are commonly distended with blood. When the autopsy has been delayed for several days, this distention may not be observed. The vessels of the brain are generally found congested; and in some rare instances, extravasation of the blood is seen under the membranes, or in the substance of the white matter. In 106 cases recorded by Casper effusion of blood was not found in a single instance. In one case of death from hanging, Brodie found a large effusion of blood in the substance of the brain, and he refers to another case in which there was a considerable effusion between the membranes. The venous congestion of the cerebral vessels is, however, seldom much greater than in other cases of "mechanical" asphyxia, and is largely dependent on the degree to which the lungs have become engorged.

Yelloly found, in examining the stomachs of five criminals who had been hanged, that there was great congestion in all, while there was fresh blood upon the mucous membrane in two. Such an appearance might, it is obvious, be attributed in a suspicious case to the action of *some irritant substance.* Such changes are common to all forms of asphyxiation by mechanical means.

Special Examination of the Neck. *A.* **Externally.** It has been already mentioned that the head is commonly bent on the chest, though this, of

course, varies with the position of the body in reference to the point of suspension and the position of the ligature. The neck in some cases appears stretched, and usually shows the marks of the ligature. We say usually, because, if a very soft ligature be used and the hanging period is brief, it is possible that the mark may be very slight. The actual *mark or marks of the ligature* must be carefully noted with respect to depth, direction, number, colour, excoriation, ecchymosis, width, pattern and position above or below the larynx. The ligature may slip up as the weight of the body is taken.

Depth. It is commonly depressed, as might be expected from the pressure produced by counterpoise of body and ligature. If the body is completely hanging, the depth is likely to be proportionately greater from the increased weight, and greatest opposite the point of suspension.

Direction. The course of the mark is generally oblique, and it is often interrupted. If the point of suspension lies in front, the mark may be circular, the lower jaw preventing the ligature from rising upwards to the same degree in front as it commonly does behind. Obvious deductions may be made from this as to how the body was suspended, or rather in what position; it may be important in deciding between homicide and suicide. The position of the knot may be indicated by an impression or excoriation of the skin at one spot.

Number. If there is more than one distinct mark, this must be noted for its bearing on "homicide v. suicide". The ligature commonly slips upwards after taking initial hold on the skin, causing a second or even third line of excoriation. An interrupted mark must not be mistaken for multiple marks; if the actual ligature is available, it may be applied to decide the point.

Colour. The skin in the depression is often hard, brown, or of the *colour and consistency of parchment;* or there may be only a thin line of blue or livid flushing in the upper or, less often, the lower border of the depression, and chiefly opposite the point of suspension. In some instances the mark, instead of being livid or brown, has presented itself simply as a white depression.

Excoriation. If the epidermis has become dried, a brown parchment-like mark will be seen. This is very important as a guide to the nature of the ligature, since it may reproduce the surface markings of the latter. This parchment appearance is seen some hours after death from drying of the skin, and does not represent a vital phenomenon.

Ecchymosis. Coarse bruising is not common with ligatures, owing to their broad linear hold. The width and softness of the ligature may also obviate ecchymosis; when present, petechiæ are seldom continuous along the mark.

Width. This has an obvious bearing on the nature of the ligature, a piece of string, for instance, producing a narrow and deep depression, while a strap would produce a much wider one.

Pattern. It occasionally happens that an actual pattern or impression of the material used is left on the skin. It is very important to note if such be the case, and to preserve or reproduce it for comparison. (See Fig. 58.)

Position. The position of the cord or ligature may sometimes provide an answer in cases of suspected murder by hanging. The following table shows

that in more than four-fifths of all cases of *suicidal* hanging, the ligature is found encircling the neck between the chin and hyoid bone:—

			Remer	Devergie	Casper	Totals
Above the larynx	.	.	38	20	59	117
Across the larynx	.	.	7	7	9	23
Below the larynx	.	.	2	1	0	3
			—	—	—	—
			47	28	68	143

If the body is only partially suspended, there is a greater tendency for the noose to take a lower position in the neck.

A man arrested for trespassing in female attire on board a ship in the London Docks was placed in a police cell to await hearing of the charge before the Magistrates. He was found, during one of the routine night inspections, lying under the bench seat of his cell face down, suspended by the neck by means of his tie, dead. Only the shoulders, neck and head were clear of the ground, the body being almost horizontal under the bench. The line of the ligature (which was a slip-tie) was almost horizontal, at thyro-hyoid level: pronounced asphyxial changes were present.

Fig. 58. Plaited impression of noose on cuticle of neck.

B. **Internally or on Dissection.**   Ruptures of blood vessels, muscles, tissues, etc., may be seen.

Ecchymosis. It was formerly believed that the deeper marks produced by the ligature were invariably discoloured from effusion of blood, or ecchymosed, but more correct observation has shown that this is not so. When ecchymosis does exist, it is commonly superficial and slight. In the bodies of persons who have been judicially executed, it is not unusual to find ecchymosis, but even there it is not always present. In a case examined by Taylor, there was only a slight trace of ecchymosis in one spot where the knot in the cord had produced contusion. That it should occur in judicial executions is not surprising, considering the form of violence employed on these occasions, but it has been somewhat too hastily assumed that the appearances found in executed criminals are met with in all cases of death from hanging. The mark is not infrequently a mere indentation on the neck without even any abrasion of the cuticle or ecchymosis, the tissues underneath being bloodless from pressure. The matter may thus be summed: if the violence to the neck has been sufficient and applied sufficiently roughly to rupture small blood vessels, then there will be ecchymosis, and the greater this ecchymosis the greater the probability that life was present at the time

of hanging; if, on the other hand, the violence has been gradually and quietly applied, there will be less chance of ecchymosis, even if the person was suspended while still alive. Prinsloo and Gordon[1] have given warning of the ease with which dissection artefacts may be assumed to be due to *ante-mortem* pressure.

Injuries to Arteries and Muscles. Injuries to the muscles and deep-seated parts of the neck are only likely to be seen when considerable violence has been used in hanging. In many instances the lining membrane of the common carotid artery is found split. Injury to the carotid arteries is a valuable sign in hanging and strangulation. These arteries may be injured by the ligature when the artery is sufficiently stretched and squeezed. The injury consists partly in a rupture of the inner and middle coats, partly in extravasation of blood from the vessels of the walls of the carotid artery. The stretching of the vessel has more to do with bringing about the lesion than the compression; in support of this view, we may instance cases where the rupture of the arterial coats is situated at a distance from the site of the ligature. The stretching of the artery necessary for the rupture of the vessel may be caused by the drop suddenly increasing the pull upon the ligature through the weight of the body, or by the movements of the body directed towards freeing the neck from the noose. Though rupture of the vessel may be produced by suspension of the corpse after death, extravasation of blood is a vital phenomenon, and thus becomes a valuable sign pointing to suspension during life.

Injuries to the Spinal Column and Cord. These are commonly found only in judicial hangings, usually at C 3/4 or 4/5, but they do occur in those who drop into the noose, as from precipitation from a stairway or platform.

Fractures of Larynx and the Hyoid Bone. These injuries have been recorded by various observers, but they are comparatively rare in hanging. They are, however, frequent in strangulation where more local violence is used (*vide* "Strangulation", p. 493).

We must now consider the medico-legal questions that arise in a case of hanging. These we shall consider in the following order:—

1. Was death due to hanging, or was the body suspended after death?
2. Was it accident, suicide or homicide?

Was Death due to Hanging, or was the Body hanged after Death?

When a person is found dead and his body suspended, there may be a question whether death really took place from hanging or not. In investigating a case of this kind, we may draw inferences from both the *external* and *internal* appearances of the body. The former alone may be sufficient to provide an answer to this question, but it is, as a rule, the internal appearances of the body that enable us to say whether any other cause of death existed or not. Both of these points are of extreme importance, and it must never be presumed that a most thorough autopsy can be dispensed with.

of its production. It has been stated that, far from being constantly livid or ecchymosed, this condition is, in reality, not seen in more than one-half of the cases which occur. But admitting that we find ecchymoses in the course of the ligature, are we always to infer that it must have been applied while the person was living? The answer to this is undoubtedly that the greater the effusion of blood the greater the probability that circulation (and life) was proceeding at the time; if there is no effusion, it is impossible *from the mark alone* to say whether the body was alive or dead when suspended. We must then rely on internal changes.

In *R. v. Ley* and *Smith* (C.C.C., 1946), the marks of the suspending ligature were faint, and devoid of ecchymoses along their margins: indeed, when seen on the day following autopsy little drying or "browning"—had occurred and it was still uncertain what force had been applied. Internally, however, there was intense engorgement of the vascular beds of the lungs and many petechiæ were present over their surfaces, the lower lobes were slightly collapsed. The heart was turgid with cyanosed blood, and more markedly distended on the right side: a few petechiæ lay over the back of the right ventricle.[1]

A microscopic examination of the tissues should be undertaken in order to observe whether extravasation has occurred (indicating that the circulation was active at the moment of suspension). Dissection artefacts must be excluded.

Sometimes, besides ecchymoses, there are abrasions of the skin in the course of the cord, and these may be proved to have been produced during life in the same way.

The impression made by the ligature may be hard and brown, although it does not usually acquire this colour until some hours have elapsed after removal of the ligature. It depends upon a drying of the skin which has been compressed by the ligature. Sometimes the upper and lower borders of the depression present a faint line of redness or lividity; and it is generally found that when the ligature presents any knots or irregularities, those portions of the skin which sustain the greatest compression are white, while those which lie between are found more or less ecchymosed. It is in this manner that the form of a ligature is sometimes accurately brought out. It may be remarked that the parchment-like appearance of the impressions produced by the cord that the characters which they present are the same, whether the hanging has taken place during life or soon after death.

Effects of hanging a Dead Body.

The following are the results of experiments performed by Casper.

1. The body of a man, aged 28, was suspended, an hour after death, by a double cord passed round the neck above the larynx. The body was cut down and examined 24 hours afterwards. Between the larynx and hyoid bone there were two parallel depressions, about ¼ inch deep, the skin having a brown colour with a slight tinge of blue, and a leathery consistency: in certain parts it was slightly excoriated. There was no effusion of blood beneath, but the muscles which lay above the compression were of a dark purple colour, and the blood-vessels of the neck were congested. The appearance of the body was such that any person unacquainted with the facts would have supposed, on looking at it, that the hanging had really taken place during life, for there was nothing to indicate that the body had been hanged an hour after death. 2. The body of another young man was hanged an hour after death, and an examination was made the following day. The two depressions produced by the double cord were true of a yellowish brown colour, without ecchymoses; the skin "appeared as if it had been burnt", and felt like parchment. 3. The body of an old man who had died from dropsy, was hung up two hours

[1] The Trial of *Ley* and *Smith*, 1947. "Notable British Trials". Ed. F. Tennyson Jesse. London. Wm. Hodge.

after death. The impressions presented exactly the same characters as in the preceding case. When the hanging took place at a later period than two hours after death, there was no particular effect produced.

We learn from these experiments, as well as from those performed by other observers, that the mark which is usually seen on the neck where hanging took place during life may be produced also by a ligature applied to the neck of a subject *within two hours*, or even at a later period, after death—consequently, the presence of this kind of mark on the neck is not conclusive proof that the hanging took place either during life or after death. The changes in the skin beneath the mark are also devoid of any distinctive characteristics: there is the same compression of the cellular tissues whether the hanging has occurred in the living or in the dead body. These changes are merely the result of mechanical compression.

Summary of Medical Evidence from Cord Marks. There is no certain and constant sign by which the hanging of a *living* person can always be determined from an inspection of any dead body. The external marks may be simulated to a greater or less degree in a *dead* body, and the internal appearances do not always furnish characteristic evidence. Nevertheless, when the *greater number of the signs enumerated are present*, and there is no satisfactory cause to account for the death, we have strong reason to presume that the deceased died from hanging. Medical evidence must not be ignored, merely because plausible objections may be taken to isolated portions of it. Facts may show that, however valid such objections may be in the abstract they are wholly inapplicable to the particular case under investigation. Perhaps the greatest difficulties occur in connexion with those cases of *suicide*, in which only slight appearances attend death; but on these occasions circumstantial proofs are usually forthcoming.

In cases in which there is no ecchymosis in the seat of the ligature caution should be exercised in expressing an opinion that hanging took place after death. Experience shows that numerous cases of hanging during life would be pronounced to be cases of hanging after death if the mere absence of ecchymosis in the course of the cord were taken as the determining factor. The discovery of marks of violence on the body is not in itself sufficient to rebut the presumption of death from hanging. The violence should at least be of such a nature as to account for an immediate unconsciousness, or it can throw no light upon the question whether the person might not have died from suicidal hanging.

If, in connexion with a body found hanging, a doctor should assert that death had *not* taken place from this cause, this would be tantamount to declaring that the deceased must have been murdered—because it is difficult to suppose that anyone but a murderer would have any motive for hanging up the body of a person recently dead. Hanging after death has been occasionally done with the object of concealing the real cause of death, and of making the act appear to be one of suicide.[1]

A woman was found suspended to a beam in a barn. Owing to the absence of any vital marks of hanging about the face and neck of the deceased, a critical examination of the body was made. In the course of the inspection, a small penetrating wound, evidently inflicted by a round instrument, was discovered on the right side of the chest, but in great part concealed by the breast on that side. On tracing the wound, it was found to pass between the fifth and sixth ribs, completely perforating the heart from right to left. A considerable effusion of blood had taken place internally, which had been the cause of death. It was therefore assumed, from the result of this inspection, that deceased had been killed, and her body suspended after death.

Dr. Eric Gardner once saw a man hanging by a cord. His throat was cut deep and wide across the thyro-hyoid membrane, immediately below the line of the ligature, and it was evident that he had tried to commit suicide by this means—unsuccessfully—before suspending *himself* in the rope. The throat wounds bore classical tentative cuts on the left side of the neck (deceased being known to the right-handed) and in direction and slope gave further indications of deliberate self-infliction. No asphyxial changes were present internally for deceased had evidently been able, even after suspension, to breathe through the wide-throat wound dividing thyro-hyoid membrane. This remarkable specimen is preserved in the Gordon Museum of Guy's Hospital.

Was it Accident, Suicide, or Homicide?

Accident. Accident is very uncommon; we may merely give a few examples without much discussion, inasmuch as the circumstances surrounding any such case are nearly certain to clear up the matter.

The death of Scott, the American diver, shows how readily asphyxia may be induced by a slight compression of the throat, even when a person might be supposed to have both the knowledge and the ability to save himself.

This man was in the habit of making public exhibitions of hanging, and had frequently given them without harm; but on this fatal occasion, it is probable that a slight shifting of the ligature from under the jaw caused compression of the throat of such a kind as speedily to produce unconsciousness and then asphyxia. No attempt was made to save him until it was too late, and he was not brought to a hospital until 33 minutes had elapsed. He was allowed to hang 13 *minutes*—the spectators being under the impression that the deceased was only prolonging the experiment for their gratification.

A girl of 13 was hanged by accident. She was swinging in a brewhouse, and near the rope used by her was another for drawing up slaughtered sheep. In the course of play her head got through a noose of this second cord, which pulled her out of the swing, and kept her suspended at a considerable height until she was dead.

A child of ten had been amusing himself by swinging from a piece of plaid-gown fastened to a loop in a cord, which was suspended from a beam. In the act of swinging, he raised himself up and gave himself a turn, when the loop of rope suddenly caught him under the chin, and suspended him until life was extinct. Another boy who was in the room did not give any alarm for some time, thinking that the deceased was at play.

It will be seen that the circumstances in which such cases occur are sufficiently indicative of the manner in which the hanging took place. Indeed, circumstantial evidence nearly always enables it to be determined whether the hanging was accidental or not: even those cases in which masochism is suspected (*vide supra*) are now seldom mistaken as suicides.

In *R. v. Montague*, Mrs. Montague, who, though apparently a strict disciplinarian, had no motive for, or intention of, hanging her child, was charged with causing its death by hanging. She had tied the child's arms with a stocking fixed to a string, which, in turn, was fixed to a ring in a cupboard; in some extraordinary way the stocking slipped up to and around the neck of the child. The absence of motive for killing was considered by the jury such a strong point in her favour that they gave her the benefit of the doubt. *The charge of murder was reduced to one of manslaughter.*

An alderman was found dead near his residence. He was seen on the previous night at his garden-gate alive, smoking a cigar, and was discovered near a coppice drive, down the embankment of which he had apparently fallen, with his neck jammed between the forked branches of a tree and his legs suspended up the embankment. He was unable to extricate himself.

Suicide or Homicide? In dealing with this question, the medical witness must weigh all the factors of the case. It is not the duty of the medical witness to decide whether a man has hanged himself, or has been hanged by another, but merely to state, when required, the *medical circumstances* which support or rebut the one or the other suggestion. The factors to which consideration should be given are all or some of the following:—

1. Statistics.
2. Circumstantial evidence as to time, place, and opportunity.
3. The nature of the ligature and its method of application.
4. The marks of the ligature.
5. Wounds and other injuries.
6. Tying or fixing of the limbs. Gagging.
7. Difficulty of self-suspension from physical deformity or defect.
8. Position of body.
9. Circumstantial evidence, including signs of a struggle.
10. General remarks on homicidal hanging.

1. Statistics. These are suggestive as far as can be, for murder by hanging is very rare, but suicide by hanging is common and has been known to take place at all ages, from youth onwards. The discovery of a person dead from hanging is thus presumptive of suicide, all other circumstances being equal.

2. Evidence of Time and Place. These are self-evident factors in most cases. A murderer is unlikely to choose either time or place at which he is likely to be interrupted or observed. A suicide may be equally secretive, it is true, but there may then be other circumstantial evidence such as doors and windows locked and fastened on the inside, letters indicating intention, etc.

3. Nature and Method of Application of Ligature. This should be carefully observed. Suicides usually take the material that is most accessible —braces, clothes line, neck-tie, scarf, etc. or there may be evidence to show where the material came from and how it reached the place where it was used. There may also be evidence of premeditation in fixing the point of suspension. For the evidence derivable from knots and their nature, the number of turns in the ligature, etc. (*vide* "Strangulation".) A self tied knot or slip-tie may be adjusted anywhere round the neck.

A young man who was arrested on a charge of deserting his wife and children, committed suicide in a cell at Hove police-station, by hanging himself with a piece of lining from his coat, which he suspended from the bell-handle. A verdict of suicide was returned, there being no evidence to show the state of mind.

The wife of a publican was found lying dead on the floor. Apparently she had hanged herself with a piece of tape upon a peg behind the bar door, and the peg had broken after death had taken place.

Equally ill-founded is the assertion that the existence of *two impressions* on the neck affords proof of homicide. One of these impressions may be lower down the neck, and circular,—the other at the upper part, and oblique owing to the noose slipping from a first position to a second. This is more common than is thought, merely requiring care for its detection.

Fig. 59. Hanging. A characteristic scene in self-suspension. The door was locked and the book close to the feet appeared to have been used to enable deceased to hook a loop up over the hat peg; the tie has slipped causing partial suspension.

In some instances homicidal interference may be inferred if there are two distinct impressions, but such impressions alone could not establish the fact of murder; this "doubling"—even "trebling" of the marks need not dissuade one from a conclusion of suicide.

A woman was found hanging from the branch of a tree with her feet resting on the ground. There were two marks on the neck, one suggestive of strangling with the same ligature as that by which the body was hanging. Walter concluded that the mark produced by the suspension of the body was the result of *post-mortem* hanging after murder by strangulation.

In another case, a boy, aged nine, was found hanging. There were marks of pressure on the neck which at first led the medical examiners to draw the inference that the boy had been strangled, and afterwards hanged. Both cases were probably suicides: that of the boy appeared almost certainly so.

The injury done to the neck by the cord or ligature can rarely afford any clue to the manner in which hanging took place. The circumstances in which the body is found are more likely to support the suggestion of homicide, or suicide. As a rule, a long drop in suicidal hanging is rare, so that great violence to the tissues of the neck is seldom seen.

An inquest was held in a case of suicidal hanging in which the deceased had fixed the rope to the top of a beam in a lofty barn, and had given himself a drop of about fifteen feet.

We have seen three cases of a suicide by precipitation over the railing of a landing to the space beside the stairway—all causing fracture dislocation of the neck with varying degrees of muscle tearing and deep fascial (and carotid) bruising.

These cases will serve to show that severe injury to the neck may be occasionally met with in suicidal hanging: it is, however, not common.

5. **Wounds and other Injuries.** The presence of marks of violence on the body of a hanged person is important, and it is necessary that a medical witness should notice accurately their situation and nature. Having satisfied himself that they must have been received during life, he will have to consider the probability of their being of accidental origin or not. These marks of violence are not always unequivocal proofs of murder; for they may more likely have been produced by the deceased himself before hanging; having failed in committing suicide by such means, he may subsequently have decided to hang himself. A hanged person may bear the marks of a firearm wound, his throat may be cut, his body bruised or disfigured, and yet, before a suspicion of homicide is allowed to be entertained, it ought to be clearly established that such injuries could not, by any probability have been self-inflicted.

Marks of violence on a hanged person may occasionally be due to *accident*. If the person has precipitated himself from a chair or table, he may have swung or fallen against articles of furniture, and thus have sustained abrasions or bruises. The rope may have given way, and the person in falling may have injured himself; but he may afterwards have succeeded in suspending himself again. Such an occurrence may be rare; but when the presence of these injuries is made to form the chief ground of accusation against another person, their possible accidental origin ought not to be overlooked.

If we suppose the deceased to have been hanged in a state of intoxication or narcosis, medical evidence alone will rarely suffice to determine the question of homicide or suicide. A suicide may make more than one attempt to take his life, and in more than one way.

Had the body been found hanging in suspicious circumstances, there might have been a strong presumption of murder.

We must also weigh carefully the probable consequences of the injuries that are found in deciding whether the suspension has been suicidal—or could not have been possible.

A man was found hanging in a room by a cord attached to a nail in the ceiling. In the upper part of the neck there was a deep wound, through which the cord had passed. A ladder was placed against the wall by the side of the body. *The room was secured on the inside by the door being bolted.* The deceased's clothes were spotted with blood, and his hands were also bloody but free from injury. Faeces had been discharged. The face had a slight violet tint, and the tongue, which had been forcibly thrust through the teeth, projected about an inch from the mouth. The wound in the throat was situated between the chin and hyoid bone, and extended from the angle of the jaw on one side to the opposite angle. It had penetrated through the mouth to the back of the throat, dividing only some small branches of the thyroid artery, and its edges bore other cuts.

In this case it was remarkable that he should still have had sufficient power to do what the evidence showed he *must* have done—namely, to place a handkerchief to his wound to arrest the bleeding; to go upstairs to another room, and to search in a table-drawer for the cord with which he intended to hang himself; to place a ladder against a wall, and to make use of this for the purpose of fixing a cord to a nail in the ceiling—an act which *could be* performed only with great difficulty. In all these circumstances, it was not surprising that homicide was suggested, and yet suicide was the only possible explanation.

A woman was found hanging in her room. There were two penetrating wounds on the left side of the chest; these had perforated the pericardium, and touched the surface of the heart, without entering its cavities. There was a basin of bloody water, and a bloody sponge, on the table; the right hand was stained with dried blood. The door and window were fastened on the inside. This was a case of suicide where, after inflicting the wounds, the deceased had hanged herself. The mark on the neck was nowhere ecchymosed, but of a yellowish or parchment colour. There was nothing in the nature of the wounds to have prevented self-suspension.

A woman committed suicide in an unusual manner: she fastened a cord to the top of her bed-post, put her head in a noose while kneeling on the bed, made a deep wound in her arm with a razor, closed the razor, and put it aside. Becoming faint from loss of blood, she must have fallen forward, and the pressure of the cord on the neck caused death.

If, in any case, the wounds or injuries are of a mortal nature, and probably caused rapid death, the presumption of murder almost amounts to certainty.

6. Gagging, Tying or Fixing of the Limbs.

The hands or legs, but more commonly the former, have been found tied in cases of undoubted suicidal hanging, and also in accidents during masochistic acts. Yet it has been doubted whether it was possible for a person to tie or bind up his hands and afterwards hang himself. It is unnecessary to examine the arguments which have been urged against the possibility of acts of this kind for they are common. Careful consideration must be given to the question of how they are tied—material, knots, etc., before a definite conclusion is arrived at.

Suicides sometimes designedly arrange matters in a way that creates a suspicion of murder. The circumstances will usually decide the issue.

In 1953 a man and woman were found dead in a double room at the Ritz Hotel, London. The woman lay on the floor, her throat cut by a single deep incised wound of typical homicidal character. The man was found suspended from a knob on the top frame of the bed by a cord which encircled the neck, constricting it tightly: part

of his body weight was supported by a bolster placed between the buttocks and the floor. A scarf intervened between the cord and the skin of the neck, and a sock was stuffed tightly into the mouth. In the adjoining bathroom were splashed and smeared bloodstains (on the mirror and floor) and a trail of bloodstains led to the bed. When, after details had been noted and photographed, the noose and scarf were removed, a number of incised wounds of "tentative" type were found on each side of the neck: they had been inflicted by a razor. There seemed little doubt that

FIG. 60. Self-gagging before suicide by hanging. Deceased suspended himself from the bedpost in a sitting position, taking part of the weight on the pillows. He had already inflicted numerous ineffectual throat wounds.

Difficulty of Self-suspension from Bodily Deformity or Defect. It has been a debated question whether bodily infirmity, or some deformity affecting the hands, might not interfere with the capacity of a person to hang himself. This question can be decided only by reference to the special circumstances of each case. In the case of the Prince de Condé, it was alleged that he could not have hanged himself, by reason of a defective condition of one hand; it was also said that he could not have made the knots in the handkerchiefs by which he was suspended. Allegations of this kind appear to have been too hastily made in this and other instances. Determination of purpose will often compensate to a great extent for bodily infirmity, and unless full allowance for this is made there is a danger that a wrong conclusion may be arrived at. *Blindness is no obstacle to this method of committing suicide.*

8. Position of the Body. It may be stated that no evidence as to murder or suicide is obtainable from the position of the hanging body unless it is found hanging in a position in which the deceased could not have placed himself. For example, if the body is completely suspended, there must, in a case of suicide, be some object, such as a table or chair, from which the deceased stepped, or it must be possible to show that he could have placed his head in the noose without standing on a support. Where the body is partially suspended in an unusual position with the feet on the ground, there is a strong suggestion of suicide.

This matter was strenuously argued in the investigation which took place consequent upon the death of the Prince de Condé in 1830. The hearing recorded two glaring errors in medical evidence as to death from hanging: (1) that a person cannot die from hanging when the body is in any way supported, and therefore that murder must have been perpetrated; (2) that in all cases of death from hanging the mark produced on the neck by the cord or ligature must be discoloured or ecchymosed.

On August 27th, 1830, the Prince de Condé was found dead in his bedroom partly dressed, his body being suspended from the fastening of the window-sash by means of a linen handkerchief attached to a cravat which he was in the habit of wearing. The head was inclined a little to the chest, the tongue was congested and protruded from the mouth; the face was livid, mucous discharge issued from the mouth and nostrils, the hands were clenched, the toes of both feet touched the floor of the room, the heels were elevated, and the knees were partly bent forward. The point of suspension was about 6½ feet from the floor. The legs were uncovered, and had some light abrasions upon them. There was a chair near the deceased. There were no marks of violence about it beyond those which might have been produced accidentally by the chair in the act of hanging. There was no natural cause of death in the body, nor any appearance to indicate that there had been violent struggling or resistance on the part of the deceased. On the upper and lateral part of the neck there was a mark produced by the ligature, but no ecchymosis; and on the left side of the neck, corresponding to the knot of the cravat, there was a depression somewhat deeper.

The case really presented only the ordinary details of suicidal hanging. It was contended, however, that he had been strangled by assassins, and his body afterwards hanged. The features presented by the mark on the neck, and the erect position of the body with the feet on the floor were the chief medical factors on which those who adopted the plainly erroneous hypothesis of murder rested their case. In order that death should take place from hanging, it is not necessary that the body should be freely and completely suspended.

Innumerable cases have been recorded in which death has taken place from hanging where the feet were in contact with the ground, or the persons were almost sitting or recumbent.

The reports of 11 such cases showed that in three the bodies were found nearly recumbent; in four in a kneeling posture, the body being more or less supported by the legs; and in four the persons were found sitting. In one case the deceased, a prisoner, was found hanging to the iron bar of the window of his prison, which was so low that he was almost in a sitting posture. The ligature which he had used, was a necktie, but (what was more remarkable in the case), the hands of the deceased were found tied by another handkerchief. The body was warm when discovered. There was no doubt that this was an act of suicide; yet, if the body had been found in an unfrequented spot, the discovery of the hands *tied*, if not the position, would have led to a strong suspicion of murder. In his position the deceased had succeeded in tying his hands together by means of his teeth.

On the contrary these facts should be regarded as evidence against homicide; for there are probably few murderers who would suspend their victims, either living or dead, without taking care that the suspension was not partial, but complete. Besides, the facts of many of these cases are readily explicable; thus, if the ligature is formed of yielding materials, or if it is only loosely attached, it will yield to the weight of the body after death, and allow the feet to touch the floor, which might not have been the case at first. If there is reason to believe that the body has not altered its position after suspension, we must remember the rapidity with which insensibility usually takes place and death ensues in this form of asphyxia.

9. **Circumstantial Evidence including Signs of a Struggle.** In all doubtful instances, circumstantial evidence is important. We should observe whether the doors and windows of the rooms are secured on the inside or on the outside; whether the clothing of the deceased is at all torn or disarranged, or the hair dishevelled; whether the attitude of the body is such as to show interference after death; whether there are marks of blood about the body, on the ligature, or in the room; whether the hands are bloody, or present marks of wounding, or of a struggle; whether the rope or ligature corresponds to the impression seen around the neck; and last, whether the cord is of sufficient strength to support the weight of the deceased. Some of these matters fall, it is true, more within the province of the police than of a medical practitioner; but the latter is generally the first who is called to see the deceased, and therefore unless such facts are noticed by him on his visit, they may often remain altogether unrecorded. The medical opinion of the actual cause of death must be based on *medical* facts alone, but circumstantial evidence has on various occasions assisted in elucidating a doubtful case. Louis states that, on removing the body of a man who was found hanging, the rope was observed to be stained with blood. This simple circumstance led to *further investigation, by which it was discovered that the person had been murdered,* and that the body had been suspended afterwards. The presence of marks on the neck, indicative of strangulation, which the cord was not likely to have produced may lead to a suspicion that the hanging followed death.

It must be remembered that insane persons may throw a room into great disorder before committing suicide, and, moreover, as they may have made an attempt (prior to hanging), by cutting, blood may be scattered about the room; every detail as to nature of other injuries and of such stains may be important.

10. Difficulties in Homicidal Hanging. It has been truly observed that of all the forms of committing murder, hanging is one of the most difficult, and it is therefore but seldom resorted to. In most cases, when a body had been hanged by a murderer, it has been after death, in order to avoid suspicion of homicide. Hence the discovery of a body hanging affords *prima facie* evidence of suicide, assuming it to be certain that death has taken place from this cause. A man may, however, be murdered by hanging without there being any evidence of this from the condition of the body. The circumstances in which this conclusion may be justified are: (1) When the person hanged is feeble and the assailant a strong man. Thus, a child, a youth, a woman, or a person at any period of life who is worn out and exhausted by disease or infirmity, may be killed by hanging. (2) When the person hanged, although usually strong and vigorous, is at the time in a state of intoxication, under the influence of narcotics, or exhausted by his attempts to defend himself. (3) In cases where many persons act in combination against one person (e.g., lynching). With these exceptions, then, a medical practitioner will be correct in a suspected case, in deciding in favour of the presumption of suicide. Unless the deceased suffered from stupefaction, intoxication, or great bodily weakness, one would expect to find, in homicidal hanging, marks of violence on the body; for there are few persons who would submit themselves to be murdered without offering some resistance. The following is a singular case of attempted murder by hanging:—

A woman, aged 69, was charged with attempting to hang her husband, who was some years older. It appeared that the accused contrived to twist a small rope three times around the neck of her husband, while he was lying asleep. She then tied him up to a beam in the room, in such a manner that when the neighbours entered, he was found lying at length on the floor, which his head raised about one foot above it. He was insensible; his hands were lying powerless by his side, his face was livid, and it was some time before he could be aroused. Had he remained longer in this position he would have died. According to his statement, he went to bed sober, and he was not aware of anything which had passed during the attempt to hang him or afterwards until he was resuscitated. The woman had no ill-will against her husband, and was herself at the time intoxicated. It seems hardly possible that any man should be so sound asleep as not to be awakened by the attempt thus made to hang him. The probability is that the husband was, like his wife, intoxicated.

A man named Eyraud, and a woman named Bompard, succeeded in hanging a man named Gouffé. The victim was enticed into an alcove for the purpose of an interview with Bompard, who had been his mistress. In the alcove, Eyraud was stationed behind a curtain, and a compound pulley with a rope and hook was so fixed that whilst Gouffé was sitting on a sofa with Bompard on his knee, she passed a silken cord round his neck, and then passed the free end of the noose, which was provided with an eye, to Eyraud, who slipped it over the hook and hoisted up Gouffé.

TRAUMATIC ASPHYXIA

One of the most striking examples of the mechanical localization of asphyxial changes is seen in the condition described as "traumatic asphyxia". It is usually confined to the head, neck and shoulders and results from a heavy compression of the chest, a maintained pinning which obstructs the

flow of venous blood from the head and arms, stemming it across the upper chest and causing a rapid rise in venous pressure in the neck, shoulders and the head: these parts rapidly become turgid with blood and intensely cyanosed.

The most pronounced cases are seen when the pinning force is not merely heavy and maintained, but also moves, rolling up over the trunk and chest towards the shoulders. The blood in the great veins is then not merely stemmed; it is thrust back into the smaller veins and capillaries of the head and neck, raising the pressure in them so rapidly as to burst their walls, a shower of deeply cyanotic petechiæ breaking out in the scalp, face, conjunctivæ and over the shoulders—often limited by the restrictive pressure of a collar or braces.

Cases are most commonly seen in crushing by vehicles or under machinery.

A man making an adjustment to the shaft of a lorry lay on the ground under the rear close to the bulbous differential casing. He shouted an "O.K." to his mate in the cab, intending the vehicle to move forward, but it reversed, pinning him, sliding slightly on the ground. He uttered a stifled shout—that unfortunately caused the driver to stop, still pinning the victim across the chest. He was released "a few moments later" but was dead on the arrival of the ambulance some ten minutes after the accident.

In another case a 23 year old lorry driver's mate was attempting unaided, to couple a trailer which stood on a slight incline to the rear of a lorry when he somehow became pinned between the two vehicles: the trailer brake was found in the "lightly on" position and it seemed probable it had run slowly down the slope, pinning and crushing him. He stood propped between the two vehicles, dead when found.

In both of these cases the classical changes of traumatic asphyxia were present to a pronounced degree, but this is not always so: any kind of pressure on the chest, if sufficient to embarrass, may become dangerous to life when other adverse factors enter into the conditions operating. Narcosis and drunkenness are notable adjuvants in this respect, for a degree of suboxia already stalks abroad to menace survival in the event of a new adversity.

Hare, in giving "King's evidence" against Burke in that notorious case, described how Burke "got stride-legs on top of the woman on the floor" ... "put one hand under the nose and the other under her chin". "He stopped her breath." She was already hopelessly drunk, like previous victims of this method of murder. (From Notable British Trials. Ed. Wm. Roughead. 2nd Ed. 1948. Wm. Hodge, London).

A child of 15 months was found jumping up and down in the cot where his seven week old brother lay: they slept on each side of a separating board placed across the middle of the cot. He was standing and jumping on both the chest and the head, and as the face was turned down into the pillow, suffocation had followed. There was no suspicion attaching to the parents—who were asleep in another room at the time. Autopsy revealed well marked asphyxial changes, pronounced in the face and over the shoulders.

dead of suffocation, pinning and crushing of the neck, chest or abdomen, vagal inhibition, regurgitated vomit inhalation, prolonged suboxia, etc., etc.[1] Several showed "crush syndrome" lesions and Bywaters studied a group of these in hospital during the next few days.[2]

There were variable degrees of asphyxial change, some more pronounced in the head and neck, some localised to limbs, with heavy clothing pressure patterns. Some showed no appreciable suboxial features: some, indeed, survived uninjured. One of the last to be released from the pile of victims was a girl of seven who stood up and walked away unaided.

[1] Simpson, K., 1943. *Lancet*, 2, 309.
[2] Bywaters, E. G. L., and Beall, D., 1941. *Brit. med. J.*, 1, 427.

CHAPTER XVI

LIFE ASSURANCE—WORKMEN'S COMPENSATION RELATIONSHIP OF TRAUMA TO DISEASE

GENERAL LIFE ASSURANCE

A Life Assurance is a contract whereby, in consideration of a sum of money called a *premium*, paid either in a gross sum or in instalments—proportioned to the age, sex, profession, health, and other circumstances of the life concerned—the assurer undertakes to pay a stipulated sum, or an equivalent annuity, upon the death (or arrival at a certain age) of the person whose life is assured.

The document setting out the terms of the contract is called a *policy*. Litigation sometimes arises concerning the stipulations of the policy, and the meaning of medical terms used in it.

A sum payable on the death of the assured is not recoverable until proof of death has been furnished, and it is established that the mode of dying does not render the contract void. Certain policies carry a clause excluding suicide within a stipulated period.

The Policy Is a Contract

Inasmuch as in all contracts the law requires each party to comply strictly with the conditions thereof, it follows that, if any wilful fraud has been knowingly committed by the assured, or by the doctor, e.g., by concealing the existence of any disease from which the assured was suffering at the time, or any *symptoms indicative of a disease—or if there is any wilful* misrepresentation, the contract will be void, and the premiums paid will be forfeited. This forfeiture is a usual condition in the policy. Civil actions on policies of life assurance are not infrequent, although as disputes are usually referred to arbitration, they may not be publicized.

In most cases these actions depend upon the construction put on the medical terms of the contract, and consideration must be given to the manner in which the medical facts are stated. The questions to which replies are required may be divided roughly into general and special.

in fact, they have not done so properly, or at all. Assurance companies are wholly reliant on the honesty and conscience of doctors in such matters.

Special Replies

It is now a general practice for most life assurance companies to appoint medical officers of their own, to whom candidates may present themselves. Alternatively, a medical report from an independent medical practitioner is submitted for inspection to a medical officer of the office, and the latter may either pass the applicant or may cause further inquiry and report to be made. Usually a personal interview will be required.

If a medical practitioner signs such a certificate, it is his duty to exercise the greatest caution, not merely replying to the questions on the paper, but giving *all particulars known to him respecting the state of health of the applicant*. There is no intermediate course: the duty must either be performed carefully, conscientiously, and honourably, or it must be declined altogether. Any equivocation or concealment in the certificate is unlikely to escape detection.

Assurance offices are not to be blamed for making these searching inquiries and for acting with caution. Frauds have frequently been attempted, and it is only by the adoption of such searching inquiries that companies can protect themselves.

Litigation sometimes turns upon the meaning of the expression "*Any other disease or disorder tending to shorten life*," and the opinions of medical experts may be required in order to elucidate this issue.

It is impossible to lay down any general rules for determining what diseases have and what diseases have not a tendency to shorten life. Any deviation from health might be so interpreted; but the law regards the expression as applying only to those diseases which, in the medical view, are regarded as of a serious nature, and, as a general rule, are likely either directly or indirectly to affect the duration of life of any person suffering from them. This particular expression does not imply that the assured must have been at the time entirely free from latent disease in order to render a policy valid; such a condition is impossible. A man may be suffering from an insidious disease such as ulceration of the stomach or an incipient neoplasm, but if this be, as it often is, both unknown to himself and is not suspected on medical examination, the assurers are bound to take the risk. In other words, a life may be a good life, although the person at the time may be suffering from latent or incipient disease.

A young man died from caries of the spine, with psoas abscess, etc., within a year of his assurance. The abscess was present at the date of assurance; but, as the candidate was unaware of it and the medical officer did not detect it, the assurance money was paid promptly.

It is when the existence of disease, or even a suspected proclivity to such is concealed from the assurers, or omitted to be stated through mistake, even without fraudulent intention, that the policy becomes void in the event of death. Such diseases are not necessarily fatal, but that is not the question: the *tendency* implied is to diminish the expectation of life, and if this is established by medical evidence in regard to any disorder *concealed intentionally*, whether chronic or acute, the policy will be void, and no action will lie for the return of premiums.

Material Concealment. It has been established that no certificate for life assurance is worth more than three years' validity and the applicant

frequently shares this view; after having been attended by one doctor for an illness, he may apply to another practitioner, who may be a comparative stranger, to certify as to his condition of health for assurance. If medical men would decline to sign the papers in such circumstances, they would not only avoid censure, but would confer a benefit upon the applicant, by preventing him from obtaining a policy upon terms which may render it invalid. From what has already been said, it will be understood that the exact state of health of the person at the date of the assurance does not represent the whole of the risks incurred by the office. Restoration to health, as in a case of pulmonary tuberculosis, may be only temporary: it may speedily be followed by a breakdown; and the assurers must be informed of any previous ill-health as well as of the present condition of the applicant. The disease from which the assured had suffered may have been of a trivial kind, but the proper course is to state it. The choice will then lie with those who are to incur the risk.

A commercial traveller aged forty-nine, effected a policy on his life for £1,000. He died in the following year. Payment was refused on the ground that the answers of the deceased were untrue, and that there had been suppression of a material fact. He was asked whether he had ever been *afflicted with gout*, and he answered "No". He was asked whether the life had been offered at any other office, and if so, whether it was accepted; and he answered that it had been proposed, and accepted at an ordinary rate. These were the answers which it was alleged were false. A doctor stated that two years before the assurance, the deceased was suffering from latent gout. He had an "extremely slight attack", which lasted only about forty-eight hours; he did not tell the deceased that it was gout; he believed that he died of gout. A proposal of the deceased to another company, which had been declined, was put in evidence. On the part of the claimants it was contended that there was no evidence that the deceased had ever been "afflicted with gout".

The Court held that the assured had not been afflicted with gout at the time of the proposal; also that the answer to the other question was untrue, but not to his knowledge. The judge directed a verdict for the claimants, subject to a point reserved for the court whether the knowledge of the untruth was material.[1]

No certificate should be signed by any doctor without the definite consent of the applicant for assurance.

Some medical men have declined to make any written reply to certain questions, such as the general question: "Can you give any and what information respecting the **habits of the applicant?**" If nothing be known concerning these, it should be so stated; if, however, the existence of any habits affecting health be known, the information should not be withheld. Concealment of habits, the effect of which on health must or ought to be known to doctors, must be just as fatal to a policy as the concealment of a serious disease. Although such habits may not always be the subject of questions asked by the office, yet the law requires that the assurers should be made acquainted with all circumstances which might reasonably affect the risk. Concealed habits of drunkenness have thus given rise to medical questions of considerable importance. The existence of such habits must be known to the person himself; and the declaration which he signs is so explicit that, if intentionally concealed by him, he has only himself to blame if the policy is voided and the premiums forfeited.

In a number of cases the payment of policies is resisted on the ground

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[1] *Fowkes v. Manchester and London Assurance Co.* 32 L.J.Q.B. 153.

of concealed drunkenness and general habits of intemperance. Medical men may differ in their views respecting the effect of intemperance upon general health, and the degree to which drinking may be safely practised. Whatever may be one's opinion of the effect of such habits on health, one must reveal them, if they are known. In consequence of the frequent concealment of habits of this kind, most offices now adopt the practice of making it a special question, to which a plain negative or affirmative answer should always be given: "Are you now, and have you always been, of temperate habits?"

INSURABLE INTEREST

Any person who takes out a policy of life assurance must have an insurable interest (which must be a pecuniary interest), in the life assured. Every person is presumed to have a pecuniary interest in his own life. A wife may insure the life of her husband upon whose welfare and income she is dependent, and a husband may insure the life of his wife, but the assurance of the lives of others has been considered objectionable, on the ground that it tends to create an interest in the death of a person, and thus to encourage foul play.

The general rule as to relatives is that where the person who effects an assurance on the life of another has a legal claim upon him for support, such relationship creates an insurable interest. A son has an insurable interest in the life of a father who supports him, but not in the life of a father whom he supports.

From the evidence given at the trial of Mary Ann Cotton,[1] there is reason to believe that in some cases a life assurance has been effected secretly for the purpose of murder.

The prisoner was indicted for the murder of her stepson by administering arsenic. The prisoner over a period of a few years had fatally poisoned her mother, fifteen children, three husbands, and a lodger—making altogether twenty persons. Most of them had been insured; and in some of these cases the prisoner had claimed and received the money payable. One of her three husbands thus disposed of, and four of her children, were assured in the same office. They died in quick succession, and death had been certified as due to *gastric fever*. The prisoner obtained from the office a sum of £35 upon the death of one husband, and some smaller amounts from burial clubs by the death of the children. She then married a man with a family of children, and she appeared very anxious to have his life and the lives of his children assured. The man discovered her at an office trying to obtain an assurance on his life, and he then refused to live with her, thereby possibly saving his life. Accused was convicted of murder.

By the Children and Young Persons Act, 1933, sect. 1, severe punishment may be awarded to a person who, having the charge of a child or young person has been convicted of the ill-treatment or manslaughter of such child or young person and is proved to be interested in the death by the terms of a policy of insurance.

ACCIDENT INSURANCE

THE WORKMEN'S COMPENSATION ACTS 1925–45
THE NATIONAL INSURANCE (INDUSTRIAL INJURIES) ACT 1946

In litigation arising out of insurance against accident, whether under private policies, under the Workmen's Compensation Act, 1925, and its amending statutes, or under the newer National Insurance (Industrial

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[1] *R. v. Cotton*, 12 Cox C. C. 400.

Injuries) Act, 1946, medical evidence is usually called for. Most accident policies contain clauses providing for weekly payments during total and partial disablement (the Workmen's Compensation Acts provided, without a policy, for similar disablement), and in these cases as well as in ordinary private cases (under Lord Campbell's and other Acts) the amount of damage must be proved; the medical evidence is the principal means by which disablement and personal damage can be estimated.

WORKMEN'S COMPENSATION ACTS 1925–45

For the purposes of the Workmen's Compensation Acts, a "workman" meant any person who had entered into or worked under a contract of service with an employer. Persons employed otherwise than by way of manual labour whose remuneration exceeded £420 a year were excepted (among others) from the statutory definition of "workman."

A servant has been defined by the Court of Appeal as "a person subject to the command of his master as to the manner in which he shall do his work; and the greater the amount of direct control exercised over the person rendering the services by the person contracting for them, the stronger are the grounds for holding it to be a contract of service; and, similarly, the greater the degree of independence of such control, the greater the probability that the services rendered are of the nature of professional services, and that the contract is not one of service."[1]

The Workmen's Compensation Acts provided for payment of compensation to a workman who was rendered totally or partially incapable of work by injury resulting from an accident, and the right to claim compensation was based on the proved inability to earn wages as a result of such accident. There was no provision for pain occasioned by the accident. The accident, to be the subject of compensation, must have arisen *out of and in the course of* employment, and prior to July 5, 1948.

The Acts also provided for the payment of compensation in cases where a worker died or was disabled through having contracted one of certain scheduled industrial diseases.

NATIONAL INSURANCE (INDUSTRIAL INJURIES) ACT, 1946

This comprehensive Act was designed to take the place, as from July 5, 1948, the appointed day, of the Workmen's Compensation Acts. "Workmen's Compensation" no longer became payable in any case where a right to compensation under the National Insurance Scheme arose in respect of employment after the appointed day. The National Insurance (Industrial Injuries) Act provides that all persons employed in insurable employment shall be insured against personal injury caused by accident arising out of and in the course of a person's employment, and against specified diseases and injuries due to the nature of such employment.

Three Forms of Benefit are provided for:

  (a) *Injury Benefit*, payable upon claim by an insured person who is injured by an accident which arises out of and in the course of his employment.

  (b) *Disablement Benefit*, arising when, following an accident, the person suffers loss of physical or mental faculty, and

  (c) *Death Benefit*.

[1] [1910] 1 K. B. 543, at p. 550.

These benefits are payable even when the injury is sustained in contravening any statutory or other regulation applicable to the employment, in disobeying orders, acting without instructions, meeting an emergency in the premises or even when travelling in a vehicle to or from his place of work.

Further, the Act does not define "an accident", but would include "any unlooked for mishap or untoward event which is not expected or designed", such as hernia or rupture of an aneurysm.

All claimants are, by Regulations, required:

(a) to give notice of any accident "as soon as practicable".

(b) to make claims in the prescribed manner, and within a defined period (21 days for injury benefit, 1 month for disablement benefit, and three months for death benefit).

(c) to give notice of any change of circumstances affecting the receipt of benefit.

(d) to submit to medical examination, treatment, vocational training or rehabilitation as may be required.

The Employer is required to take reasonable steps to investigate such accidents and to furnish information for determining claims or questions arising from them.

Claims are to be in writing, and accompanied by certificates and other supporting evidence, and regulations set out the procedure to be followed in determining them, in the authorizing of certain tribunals, and the evidence required. Facilities for "increased benefits" have been made.

All claims and questions are to be submitted to the Insurance Officer appointed under the Act, who has to consider the matter immediately. He may allow the claim in whole or part unless some special question arises. If he is not satisfied he may refer the claim to the Local Appeal Tribunal, or disallow it. The dissatisfied claimant may appeal to the same Tribunal, and Appeal from the Local Tribunal lies to the Commissioner; it must be brought within three months.

Medical Boards consisting of two or more medical practitioners have been appointed by the Minister. A claimant for *disablement* benefit has his case referred by the Insurance Officer to a Medical Board for assessment, *and, in the event of dissatisfaction with that Board's decision, the claimant* may appeal to a *Medical Appeal Tribunal*, consisting of a Chairman and two medical practitioners. Any decision of either of these Boards may be reviewed at any time.

A Local Appeal Tribunal is to be constituted to represent employer and insured persons for purposes of the Act not necessarily confined to medical matters, and regulations provide that doctors may sit with the Tribunal as additional members or as Assessors.

The Act also provides for an Industrial Inquiries Commissioner to be appointed in connection with the determination of legal questions which arise, together with a number of Deputy Commissioners who are to be Barristers or Advocates of at least ten years' standing. A specially qualified medical assessor may also assist.

Insured persons are also "covered" against **prescribed diseases or injuries arising out of the nature of some special employment**, and are entitled to the same benefits without declaration that the "accident" is, in fact, an industrial accident:

SCHEDULE PART I

Description of Disease or Injury	*Nature of Occupation*
	Any occupation involving the use or handling of, or exposure to:
Poisoning by:	
1. Lead.	The fumes, dust or vapour of, lead or its compounds.
2. Manganese.	The fumes, dust or vapour of, manganese or its compounds.
3. Phosphorus.	The fumes, dust or vapour of, phosphorus or its compounds.
4. Arsenic.	The fumes, dust or vapour of, arsenic or its compounds.
5. Mercury.	The fumes, dust or vapour of, mercury or its compounds.
6. Carbon bisulphide.	The fumes or vapour of, carbon bisulphide or its compounds.
7. Benzene or a homologue.	The fumes of benzene or any of its homologues.
8. A nitro- or amido-derivative of benzene or of a homologue of benzene.	The fumes of a nitro- or amido-derivative of benzene or of a homologue of benzene.
9. Dinitrophenol or a homologue.	The fumes of dinitrophenol or any of its homologues.
10. Tetrachlorethane.	The fumes of tetrachlorethane.
11. Tri-cresyl phosphate.	The fumes of tri-cresyl phosphate.
12. Tri-phenyl phosphate.	The fumes of tri-phenyl phosphate.
13. Diethylene dioxide (dioxan).	The fumes of diethylene dioxide (dioxan).
14. Methyl bromide.	The fumes of methyl bromide.
15. Chlorinated naphthalene (excluding the condition known as chlor-acne).	The fumes of chlorinated naphthalene.
16. Nickel carbonyl.	Exposure to nickel carbonyl gas.
17. Nitrous fumes.	The use or handling of nitric acid or exposure to nitrous fumes.
18. Gonioma kamassi (African box-wood).	The manipulation of Gonioma kamassi or manufacture of articles therefrom.
19. Anthrax.	The handling of wool, hair, bristles, hides or skins, or contact with animals infected with anthrax.
20. Glanders.	Contact with equine animals or their carcases.
21. Infection by leptospira ictero-hæmorrhagiæ.	Work in rat-infested places.
22. Ankylostomiasis.	Work in or about a mine.
23. (a) Ulceration of the corneal surface of the eye. (b) Localized new growth of the skin; papillomatous or kera-totic. (c) Epitheliomatous cancer or ulceration of the skin.	Any occupation involving: *The use or handling of, or exposure to,* tar, pitch, bitumen, mineral oil (including paraffin), soot or any compound, product, or residue of any of these substances.
24. (a) Chrome ulceration.	The use or handling of chromic acid, chromate or bichromate of ammonium potassium, sodium, or zinc, or any preparation of these substances.
(b) Inflammation or ulceration of the skin or of the mucous membrane of the upper respiratory passages or mouth (including chlor-acne).	Exposure to dust, liquid or vapour.

SCHEDULE PART I—*Continued*

Description of Disease or Injury	*Nature of Occupation*

Poisoning by:

Any occupation involving the use or handling of, or exposure to:

25. Inflammation, ulceration or malignant disease of the skin or subcutaneous tissues or of the bones, or leukaemia, or anaemia of the aplastic type.

Exposure to X-rays, ionising particles, radium or other radio-active substance or other forms of radiant energy.

26. Cataract.

Frequent or prolonged exposure to the glare of molten glass or red-hot metal.

27. Compressed air illness.

Subjection to compressed air.

28. Telegraphist's cramp.

The use of Morse-key telegraphic instruments for prolonged periods.

29. Writer's cramp.

Hand-writing for prolonged periods.

30. Twister's cramp.

The twisting of cotton or woollen (including worsted) yarn.

31. Subcutaneous cellulitis of the hand (Beat hand).

Manual labour causing severe or prolonged friction or pressure on the hand.

32. Beat knee, 33. Beat elbow.

. . . knee . . . elbow.

34. Inflammation of the synovial lining of the wrist joint and tendon sheaths.

Manual labour, or frequent or repeated movements of the hand or wrist.

35. Miner's nystagmus.

Work in or about a mine.

36. Poisoning by beryllium.

Any occupation involving the use or handling of, or exposure to the fumes, dust or vapour of, beryllium, or a compound of beryllium, or a substance containing beryllium.

37. (a) Carcinoma of the mucous membrane of the nose or associated air sinuses.

    (b) Primary carcinoma of a bronchus or of a lung.

Any occupation in a factory where nickel is produced by decomposition of a gaseous nickel compound which involves work in or about a building or buildings where that process or any other industrial process ancillary or incidental thereto is carried on.

38. Tuberculosis.

Any occupation involving close and frequent contact with a source or sources of tuberculous infection by reason of employment—

    (a) in the medical treatment or nursing of a person or persons suffering from tuberculosis, or in a service ancillary to such treatment or nursing;

    (b) in attendance upon a person or persons suffering from tuberculosis, where the need for such attendance arises by reason of physical or mental infirmity;

    (c) as a research worker engaged in research in connection with tuberculosis;

    (d) as a laboratory worker, pathologist or post-mortem worker, where the occupation involves working with material which is a source of tuberculous infection, or in an occupation ancillary to such employment.

39. Primary neoplasm of the epithelial lining of the urinary bladder.

Under a further part of this schedule, regulations prescribe the group of industrial lung diseases known collectively as the pneumoconioses, which the Act defines as "fibrosis of the lungs due to silica dust, asbestos dust or other dust, and includes the condition of the lungs known as dust reticulation, but does not include byssinosis". The effects of tuberculosis accompanying pneumoconiosis are treated, under the Act, as if they were the effects of the pneumoconiosis.

SCHEDULE PART II

1. Any occupation involving:
    (a) the mining, quarrying or working of silica rock or the working of dried quartzose sand or any dry deposit or dry residue of silica or any dry admixture containing such materials.
    (b) the handling of any of the materials specified in the foregoing sub-paragraph, or substantial exposure to the dust arising from such.
2. Any occupation involving the breaking, crushing or grinding of flint or the working or handling of materials containing such flint, or substantial exposure to the dust arising from any of such operations.
3. Any occupation involving sand blasting by means of compressed air with the use of quartzose sand or crushed silica rock or flint, or substantial exposure to the dust arising from such sand blasting.
4. Any occupation involving:
    (a) the freeing of steel castings from adherent siliceous substance;
    (b) the blasting of metal castings to free them from adherent siliceous substance;
    (c) the moulding of iron castings with the use of siliceous materials;
    (d) substantial exposure to the dust arising from any of the foregoing operations.
5. Any occupation in or incidental to the manufacture of china or earthenware (including sanitary earthenware, electrical earthenware and earthenware tiles), and any occupation involving substantial exposure to the dust arising therefrom.
6. Any occupation involving the grinding of mineral graphite, or substantial exposure to the dust arising from such grinding.
7. Any occupation involving the dressing of granite or any igneous rock by masons or the crushing of such materials, or substantial exposure to the dust arising from such operations.
8. Any occupation involving the use, or preparation for use, of a grindstone, or substantial exposure to the dust arising therefrom.
9. Any occupation involving:
    (a) the working or handling of asbestos or any admixture of asbestos;
    (b) the manufacture or repair of asbestos textiles;
    (c) the cleaning of any machinery or plant used;
    (d) substantial exposure to the dust arising.
10. Any occupation involving:
    (a) work underground in any coal, tin, slate or hæmatite iron ore mine;
    (b) the working or handling above ground at any coal or tin mine of any minerals extracted therefrom, or any operation incidental thereto;
    (c) the trimming of coal in any ship, barge, or lighter, or in any dock or harbour or at any wharf or quay;
    (d) the sawing, splitting or dressing of slate, or any operation incidental thereto.

exposing them to the risk of pneumoconiosis have to submit to medical examinations before the second month of employment there is good basis for opinion on any changes found. These Boards may also suspend a claimant from his occupation, or revoke such suspension.

The establishment of these various Medical Boards, and the many medical questions which must arise out of such legislation emphasize the vital importance of doctors keeping full and meticulously accurate records of all cases coming to them under the Provisions of the Act. Doctors will undoubtedly be required increasingly for the preparation of cases by giving of reports on their personal findings.

A doctor must regard it as his duty to give every assistance to ensure a full and proper hearing of cases so far as he is concerned. The Act vests him with responsibilities which he must not discharge lightly.

WHAT IS AN ACCIDENT?

The term "accident" has not a definite legal meaning, and it may refer either to the personal injury which has resulted or to the mechanical cause of the injury. It may be defined as any unexpected or unforeseen mishap or untoward event which is not expected or designed. The distinction between an unforeseen event and the result of that event is not always clear.

In *Fenton v. Thorley*[1] it was held by the House of Lords that the word "accident", as used in the Workmen's Compensation Act, was used "in the popular and ordinary sense of the word" as denoting an unlooked-for mishap or an untoward event which is not expected or designed, or as denoting or including any unexpected personal injury resulting to the workman in the course of his employment from any unlooked-for mishap or occurrence; or any unintended and unexpected occurrence which produces hurt or loss.

In the House of Lords in *Clover, Clayton & Co. v. Hughes*,[2] it was held that the event constituting the accident must be unexpected in the sense that an intelligent man would not have expected it from the nature of the work and that it was not correct to ask whether a medical man who knew the condition of the workman would have expected it.

As a result of numerous judicial decisions, the term "accident" has been amplified and extended far beyond its original meaning, and includes many conditions which have arisen from natural disease, but in which the occupation has contributed in a minor degree to the fatal result. In the above case, for example, Hughes suffered for years from an aneurysm of the aorta; and rupture occurred while he was screwing a nut with a spanner. Although little or no exertion was required, it was held that death was caused by an accident arising out of the employment.

The wording of Section 7(1) of the National Insurance (Industrial Injuries) Act, 1946, has made the use of the word "accident" for infection by diseases like anthrax and tuberculosis a matter of disagreement among the authorities—agreed as they may be that the infection was contracted out of exposure by work.

In April 1949, the Court of Appeal granted compensation under the Workmen's Compensation Acts to a nurse who had contracted tuberculosis whilst employed by the Doncaster Corporation as a nurse in a sanatorium. (*Pyrah v. Doncaster Corporation*).[3]

[1] [1903] A. C. 443.
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But in 1950, a claim by a Tuberculosis Officer, appointed to a County Council, who contracted pulmonary tuberculosis within 17 months of his appointment failed. It was brought under the provisions of the National Insurance (Industrial Injuries) Act, disallowed by the insurance officer, allowed by the local Appeals Tribunal and ultimately rejected on appeal to the Industrial Injuries Commissioners.[1]

That part of the wording in Section 7(1) bearing on the use of the words "injury by accident" for repeated exposures to an organism refers to "further attacks" of the prescribed disease as "recrudescence". Though the term "accident" remains unmodified—or as little modified by usage under the older W.C.A. as to be immaterial—all repetitive infections seem likely now to fall within the definition of a "process"; they would require individual inclusion in a schedule, like anthrax or glanders, to become insurable risks under the Act.

It has been held that accidental injury arose out of the employment where a man in the tropics sustained sunstroke while painting the side of a ship, being subject to a greater risk of sunstroke in this position owing to the reflection of heat from the side of the vessel.[2]

The principles involved in cases of this sort were considered by the House of Lords in *Upton v. Great Central Railway*,[3] where it was laid down that it is not necessary that there should be direct active or physical connection between the act causing the accident and the employment; it will suffice if the accident arises directly out of circumstances which the appellant had to encounter because to encounter them fell within the scope of his employment.

THE RELATION OF DISEASE TO ACCIDENT OR INJURY

When an accident happens, whether it be a fall downstairs at home, some entanglement with machinery at work or a vehicular street accident, it is commonly assumed by lay persons to have been due to carelessness, neglect to take an elementary precaution or perhaps mere forgetfulness. Such "accidents" are, however, often shown by enquiry and careful clinical or *post-mortem* examination to be due to a bout of faintness or even frank collapse from disease, such as coronary occlusion or its sequelæ. It may well be that serious hurt, even fatal injury, has been sustained, but these more obvious matters must not be allowed to divert interest from the possibility—a very common happening indeed in practice—that natural disease may be at the root of the matter, an explanation (if sought) of the whole incident.

Several alternatives must be carefully considered:

(a) The victim of injury may well have become exposed to hurt as a result of natural disease such as hypertension, coronary occlusion, epilepsy and the like—capable of causing momentary faintness or even complete loss of consciousness.

(b) Environmental conditions may have been harmful, as in over-heated or ill ventilated rooms, or CO-vitiated atmospheres.

(c) The act may have been suicidal—or raise suspicion of foul play.

(d) When (a), (b) and (c) have been excluded it may usually be assumed that a frank accident has, in fact, taken place.

It is, of course, imperative that a careful clinical assessment of those still alive—or autopsy by a skilled pathologist accustomed to such problems in

[1] Decision No. C.I. 83/50. Regl. paper. CI 217/49; 10 1923 II/49. S.782 Ca '47, 49.

[2] *Morgan v. Owners of S.S. "Zenaida"* (1909), 25 T. L. R. 446.

[3] [1924] A. C. 302.

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those who have died—shall be made before a final decision is reached or any decisive opinion advanced; either may detect some previously unsuspected defect or disease capable of bearing on the circumstances.

In November 1951 a small private car collided with an oncoming charabanc in a violent head-on collision on the crown of the road. The driver sustained chest injuries including fractured L. 2nd-6th and R. 2nd-3rd ribs on each side of the sternum. There was a hemopericardium which was found at autopsy to be due to a dissecting aneurysm of the aorta. It was at first assumed that this must have been a consequence of the impact with the steering wheel which was undoubtedly responsible for the fractured ribs, but enquiry showed that the other passengers in the car had, for a few seconds prior to the collision, realised that something was wrong with the driver: there was ample room for him to have pulled off the crown of the road to his own side to avoid the collision had he been capable, and it seemed likely that he had failed to do so because a spontaneous rupture of the aorta had already taken place.

Innumerable examples of such events are on record, and this is hardly the place for a review of disease as a contributory factor, to accidents. It is, however, important to point out that, although one may look with care into the past history of an injured person in whom one has now found disease perhaps well established, one may nevertheless fail to detect any sign or symptom of its development. Many diseases which ultimately become revealed by some accidental happening—peptic ulcer, coronary sclerosis or hypertension, diabetes or neoplasm, to name but a few—may have progressed for some long period in the past without giving rise to symptoms or attracting the attentions of either the victim or of those with whom he has been in daily contact. Every doctor of experience knows how easily he may overlook the early phases of disease. Counsel who are new to such matters may have to be told that the absence of signs of ill-health, even the absence of physical signs of disease, by no means excludes the possibility that it is present—and, indeed, may have been so for some time.

It is vital to the good repute of doctors that they shall under no circumstances whatsoever be persuaded to take other than a detached view when considering the relationship of disease to trauma, whatever sympathy they may have for the bereaved family or an injured party endeavouring to obtain compensation. No sentiment must be allowed to divert them from the main issue which is to demonstrate the truth. Nothing should be withheld *and where there is uncertainty or some equivocal position exists, it is the* duty of the doctor to state the position. Both parties have an equal right to know the full facts and all reasonable possibilities that exist when their cases are stated before a court. It is more particularly in this realm of relationship between disease and accident, and between trauma and the recognition of disease (often in consequence), that the law is so reliant on the honesty and integrity of doctors.

RELATION OF WORK, STRESS OR ACCIDENT TO SUBSEQUENT DISEASE

There are many cases in which it is not difficult to form an opinion, inasmuch as the disability is the obvious and direct result of the injury caused by accident, e.g., wounds, fractures of bone, dislocations of joints, etc.

But there are many cases in which the relationship is by no means so obvious or so certain, and in which an opinion should be arrived at only after very full consideration of all the possible factors. These are cases in which the accident or the nature of employment has determined either the

onset or an exacerbation of disease which may not previously have caused symptoms.

It is common for certain disease states to remain undiscovered until some particular stress, some exertion—perhaps during working hours—causes symptoms drawing attention to them. Of these, coronary occlusion is undoubtedly the most common and important. It is a frequent cause—often discovered only at autopsy—of sudden collapse at work. So, too, may hypertensive states, diabetes, chronic nephritis, myocardial degeneration states, peptic ulcer, otitis media, pulmonary tuberculosis—and many deep-seated tumours—remain unrecognized: their discovery soon after an accident must justify the presumption that they were already established at the time—indeed, might have been the physical cause for the accidental happening. It must not be inferred from the lack of prior signs or symptoms that no disease was then present.

A man of 62, in charge of a gang about to repaint a 60 ft. flagpole stayed by wires on the lawn of an Essex hospital, insisted on being "cradled" up aloft first. Whilst aloft the stay ropes slipped and he was tilted out of the cradle. He clung on whilst a fire tender was summoned—but then suddenly seemed to let go—and crashed to the concrete platform below. Autopsy revealed hypertensive enlargement of the heart (wt. 20 ozs.) and widespread coronary occlusion by atheroma. Both conditions were so far established as to make it certain they had existed for several years prior to the accident—though no complaint of ill health had ever been made.

A mechanic of 19, lying on his back tightening a sump drain plug under a lorry, was heard to cry out. Another man, hearing this call, turned to see a spanner topple out from under the vehicle. The mechanic was pulled out unconscious and died seven hours later from a ruptured developmental aneurysm of the circle of Willis.

The degree and duration of disablement is the main point to be settled by medical evidence in most cases where a relationship is not in dispute. The relation of the alleged cause to the alleged or obvious effect is more often in dispute, and upon this medical evidence can throw much light.

A lighterman who sustained two fractured ribs in the R. upper chest in March 1951 made an unsatisfactory recovery. He never returned to his work and, some two months after the injury, was found to be suffering from pulmonary tuberculosis in the R. upper lobe—a disease from which he died five months after the date of injury. Autopsy disclosed both very old fibrotic pulmonary tuberculosis and recrudescent disease, which could reasonably be regarded as having existed for several months. It could not be denied that the chest injury was likely to have been responsible for the recrudescence of disease.

Occasionally disease itself may cause some change which is erroneously attributed to trauma; the doctor must be on the alert for such tests of his clinical acumen:

A woman of litigious mind obtained, through her M.P., a legal aid certificate enabling her to bring a claim for damages against her husband's doctor for failure to recognize leukæmia, and to commence an action for compensation on the grounds that it had resulted from an accident at work in which the forearm had been bruised. The latter was evidently a sign of a tendency to bleed which might have warned a wideawake doctor of disease of the blood forming system. Both claims failed, the former for lack of proof of negligence and the latter owing to trauma being unrelated to the development or course of the disease.

It is obvious that injury to a living tissue may be repaired without any apparent after effects; or it may lead to pathological processes without any intervening period; or it may lead to pathological processes the effect of which may remain latent for such a period of time as might suggest any relationship to be untenable.

It follows that great difficulty may arise in assessing the relationship between the disability and the original injury especially where the time interval is prolonged. When, after an injury, a disease supervenes, which may quite well have occurred had there been no trauma, the question whether the injury was a contributory or sole cause of the disease is difficult to decide; for example, when tuberculosis occurs in the lung of a person who has received an injury to the chest; or osteomyelitis of the spinal vertebræ after a minor back injury, a kidney tumour after loin injury and malignant growths of various kinds after trauma.

When a tumour arises some time after injury—and takes origin in the injured part—it is difficult to convince the layman that this constitutes no sound reason for associating the growth with the injury: such *post hoc* reasoning is unsound. It must be shown:—

- (a) that the trauma sustained was capable of affecting the locality and sufficient to cause material hurt to the tissues;
- (b) that a reasonably close association in time existed (preferably supported by intervening symptoms of developing disease in the locality);
- (c) that the disturbances caused by the injury or the processes of healing might result in an abnormal growth process—more than would be normal—or that the statistics supported such an association.

It is helpful to be able to quote figures relating injury to the disease found —though these are notoriously variable.[1] Harvey Cushing[2] decided, after a critical survey of his personal material experiences with glioma, that trauma could be ascribed a part in some 15 per cent. Parker and Kernohan, in giving a nearly similar figure (13·4 per cent) from over 400 cases also gave a warning that 10·4 per cent of a group of non-tumour bearing patients gave a history of substantial trauma to the head—and no less than 35·5 per cent of normal persons could recall a significant head injury.[3] Most of us can.

A man of 47 sustained an injury to the left brow from a falling packing-case Headaches commenced and continued intermittently for 14 months, when he suddenly collapsed with a paraplegia, dying 10 days later from hypostatic pneumonia. Autopsy revealed a malignant glioma of the right parietal sub-cortex . . . in an area susceptible to contre-coup from the head injury sustained.

In a claim made under the W.C.A. in Eire in 1954, a 40-year-old groom leading a horse had it rear and fall on him, pinning him against a wall. He sustained a bruised scrotum, but appeared to make a good initial recovery. Within 6 weeks he noticed that the swelling, instead of subsiding completely, was *enlarging again*. He was later found to have a carcinoma of the testis which was removed surgically 5 months after injury. It was a seminoma, a common spontaneous tumour at this middle age of life. It seemed more likely, as Willis has remarked,[4] that trauma merely drew attention to a tumour already present, but it might, of course, have followed that injury accelerated its growth by rupturing its natural confines. Compensation was paid out of Court.

A butcher's boy of 17 was struck on the hip by a falling case of meat, sustaining some local bruising. Two days later he felt unwell and complained of acute pain in the same hip. By the fourth day frank osteomyelitis had become developed, and pyæmia and death followed.

[1] *Vide* Behan, R. J. 1939. Trauma in Relation to New Growths. London: Baillère, Tindall and Cox, Ltd.
[2] Cushing, H., 1928. Modern Medicine. Philadelphia Lea & Febiger.
[3] Parker, H. L., and Kernohan, J. W., 1931. *J. Amer. med. Ass.*, 97, 535.
[4] Willis, R. A., 1948. Pathology of Tumours. London. Butterworth & Co.

Stern (1945) has given a very full review of this subject in his work on Trauma in Internal Disease.[1]

In all such cases it must be shown that the origin of the disability or disease could reasonably be traced to the accident, or that the accident could have been a contributing factor. It is not sufficient to show that the disease is a sequel in time to the accident, or that such a disease has been known to follow a similar injury on other occasions. It must be established that the accident was the probable or certain cause of the disease; that the weight of probability warrants the inference of casual relationship in that particular case. Though it is easier when there is a direct sequence in the march of events, we must be alive to the fact that a disease process, even when irritated by the injury, may be masked in its outward manifestations and may lead to the erroneous assumption of complete recovery—and a failure to appreciate any casual relationship between the one happening and the other.

Trauma and Infections.

When a tissue is damaged there may be no evidence of direct infection from the injury, no open wound or other means of infection from without, yet the injury may predispose the tissue to infection owing to the lowering of local resistance in necrotic tissues, to local stasis and to increased permeability of the blood vessels in that area. Bacteria circulating in the blood stream more readily infect an area of damaged tissue, although the conditions required for effective bacterial growth in such cases are by no means clear. The general nutrition of the subject, debilitating disease like diabetes, loss of blood, fatigue and exposure to cold may all play a part in initiating infection.[2]

It is not necessarily severe injuries which lead to such complications. On the contrary, minor lesions may readily lead to those conditions of diminished local resistance which result in the onset of disease.

In cases of this nature it would seem that there is only one reasonable principle which should guide the courts, *viz.*, to accept as final and decisive the opinion of the medical man who was attending the case at the time, including of course any consultant who may have been called in. In such circumstances, a medical man's sole object is to do the best he can according to his "reasonable skill and care" to cure his patient as speedily as possible; any refusal to consent to treatment should be considered as "contributory negligence".

In the second stage, it is helpful to consider what a reasonable private patient would do in similar circumstances. Obviously he would endeavour in the first place to get the best advice obtainable on the subject. Having obtained this, he would weigh and consider it, and either act on it or put up with the consequences of disregarding it. If the workman cannot obtain such skilled advice, a judge can obtain it both for the benefit of the workman and also for his own assistance.

CHAPTER XVII

PSYCHIATRY AND THE LAW

THIS chapter will deal with the relationship of modern psychiatry to medical jurisprudence, with the legal aspects of psychiatry, and with the psychiatric contribution to the law. It is important to recognise that in all aspects of the relationship between psychiatry and the law, it is in fact the law which calls the tune. The law defines the basis of the relationship, and is by definition the final arbiter in all interpretations of medico-legal problems. From a psychiatric standpoint, some of the presumptions about mental activity upon which the law at present relies, are unquestionably obsolete and unsound; and it may be difficult or even impossible for a valid and complete psychiatric opinion to be expressed within the limitations imposed by certain current legal definitions and requirements. But this fact, while suggesting very strongly the need for such concepts to be modified in the light of modern psychological knowledge, does not in any way diminish the responsibility of the medical man, and in particular the psychiatrist, for possessing a sound knowledge of the principles and practice of the law as it stands today, in so far as it affects his professional duties and obligations.

A few fundamental legal principles underlie the whole of forensic psychiatry, and from the standpoint of justice they are unexceptionable. Before further discussing their implications in practice it will be worth while to define them.

(1) The first is that a sane man must be assumed to be wholly responsible for his actions, and to intend their consequences.

(2) The second is that just as innocence must be presumed while guilt has to be proved, so equally must sanity be presumed, and insanity proved to the satisfaction of a Magistrate, Judge or jury, before it can be legally accepted.

(3) The third is that no man may be deprived of liberty, or of the privilege of managing his own affairs, on purely medical grounds; such deprivation, even if necessitated in a patient's own interests and entirely by his unsoundness of mind, can only ultimately be authorized by a duly appointed Magistrate or higher judicial authority.

(4) The fourth principle is that crime is always and essentially an affair of mind as well as of body, of intention as well as action. This is a principle which has been enshrined in English law for nearly 800 years: it is embodied in the famous legal tag "Actus non facit reum nisi mens sit rea": "There cannot be a guilty act unless there is a guilty mind".

These principles recur throughout the application and interpretation of the various Statute Laws specifically concerned with mental illness and mental deficiency; and they hold also throughout the whole body of the common law wherever this has to do with the assessment of a person's state of mind; perhaps the most controversial example being the McNaghten Rules. All this will be dealt with in the course of this chapter.

subsequently modified by certain provisions of the National Health Service Act 1946, and the Criminal Justice Act of 1948; also the Mental Deficiency Acts, 1913–1938, similarly modified by the National Health Service Act and the Criminal Justice Act. The principal provisions of these acts, together with the modifications subsequently introduced by regulations, made under Statutory instruments following the passing of the National Health Service Act and the Criminal Justice Act, will be dealt with in succeeding sections. In general it may be said that the Lunacy and Mental Treatment Acts, and subsequent regulations, deal with the treatment and care of insane persons and with the management of their property; while the Mental Deficiency Acts, and their subsequent regulations, deal similarly with the care, training and control of patients suffering from mental defect.

The following authorities set up by the Lunacy and Mental Treatment Acts 1890–1930, are responsible for the administration of the Statute Law relating to persons of unsound mind.

    (i) The Lord Chancellor (associated with other judges)

    (ii) The master in Lunacy

    (iii) The Board of Control

    (iv) Local authorities

    (v) All "judicial authorities"

    (vi) Medical Officers of mental hospitals

    (vii) Any qualified medical practitioner who is called in to perform an official duty

The Lord Chancellor, as judge in lunacy, is entrusted with the care of the person and estate of persons of unsound mind. He acts either alone or jointly with one or more of the judges of the Supreme Court who have been entrusted with such duties. The judge in lunacy may make orders for the custody of persons of unsound mind so found by inquisition and for the management of their estates. Under the control of the judge in lunacy is the *master in lunacy who must be a barrister of not less than ten years'* standing.

The Board of Control regulates the affairs of institutions for the reception of persons of unsound mind and mental defectives; and it supervises such persons of unsound mind as are not so found by inquisition. By the Mental Treatment Act, 1930, the Board consists of a Chairman (who is a paid commissioner) and not more than four other paid commissioners (one of whom at least must be a woman). Persons coming under the Board's jurisdiction are now described under three categories:

    1. Health Service patients.

    2. Private patients.

    3. Broadmoor patients.

These three categories replace all former descriptions such as "rate aided person", "pauper", "lunatic", "criminal lunatic", and so forth. Health Service patients are all patients requiring and receiving medical care for mental illness or mental defect, who do not elect to obtain this privately outside the National Health Service. *Private patients are those who do elect* to obtain their treatment privately, and Broadmoor patients are those persons who have been found either unfit to plead by reason of unsoundness of mind, to a criminal charge, or insane on arraignment, or guilty but insane, and who have been subsequently committed to Broadmoor or to a similar institution for care and treatment of their mental illness under the provisions of the Criminal Justice Act 1948.

Health Service patients are normally accommodated in the appropriate mental hospital for their area, such hospitals having now been taken over by the National Health Service from the local authority previously responsible for their provision. Private patients—other than those of unsound mind so found by inquisition—may receive treatment in registered hospitals, licensed houses, mental hospitals under the National Health Service in which there is private accommodation, or in private houses as single patients; but the Board of Control may sanction the reception of more than one person of unsound mind in a house in special circumstances, and for the benefit of single patients.

All administrative duties and powers formerly conferred on local authorities for the provision of mental hospital Outpatient Departments, are now vested in the Minister of Health under the National Health Act. Before examining further the practical application of these Statutes, it will be as well to consider the meaning of the terms insanity and mental defect in their legal context.

THE CONCEPTS OF INSANITY AND MENTAL DEFECT

Apart from its medical implications, insanity can be given a legal definition. It has been so defined as "such unsoundness of mental condition as, in regard to any matter under action, nullifies or modifies individual legal responsibility or capacity". It remains to be seen what should govern a medical man in his assessment of whether a person is or is not insane.

Perhaps the essential feature of insanity from a medical point of view is the failure, through incapacity of the individual, to maintain normal contact with external reality, and to appreciate the distinction between what is going on solely in his own mind, and what is going on beyond it in the external world, and is therefore common to his own experience and that of others. The older term "alienation of the mind", despite its disagreeable implication that insane patients were a race apart, certainly owed something of its force to just this characteristic of insanity in general: that the insane person is separated from common experience and appreciation of external reality, and to a greater or lesser degree, is compelled by his illness to live in a world different to that inhabited by his fellow men.

Sanity or insanity as concepts remain ultimately a matter of definition in any individual case. There is no definite dividing line between one and the other; and one may pass imperceptibly into the other in the development of the illness which ultimately renders the patient insane.

Taking the failure of contact and appreciation of reality as the basic criterion, it is obvious that the term insanity as ordinarily used must denote a fairly advanced degree of disturbance or unsoundness of the mind. Since it is by means of normal mental activity that an individual is able to adapt himself to his environment, and to adjust himself to relationships with his fellow men, disorder or disease of the mind is apt to display itself primarily in disturbance of thought and conduct, which may bring the individual into conflict with his environment or with his fellows. It is at this point that the law takes steps to place the person under care and restraint, either for his own safety and well-being, or for the safety and well-being of others.

In approaching the subject of insanity from a medical standpoint, three terms are of service and will be briefly described here:

1. Amentia, or mental defect.
2. Dementia, or mental deterioration.
3. Psychosis, or functional insanity.

Amentia or mental defect means in essence a state of arrested or incomplete development of mind existing before the age of 18 years, whether arising from inherent causes or induced by disease or injury. The legal concept of mental defect accepts this basic premise and goes on to divide mentally defective patients into three groups:

Idiots; that is to say, persons in whose case there exists from birth or from an early age, mental defectiveness of such a degree that they are unable to guard themselves against common physical danger.

Imbeciles; that is to say, persons in whose case there exists from birth or from an early age, mental defectiveness which though not amounting to idiocy is yet so pronounced that they are incapable of managing themselves or their affairs, or, in the case of children, of being taught to do so.

Feeble-minded persons; that is to say, persons in whose case there exists from birth or from an early age, mental defectiveness which, though not amounting to imbecility, is yet so pronounced that they require care, supervision, and control for their own protection or for the protection of others, or, in the case of children, they appear to be permanently incapable by reason of such defectiveness of receiving proper benefit from the instruction in ordinary schools.

Moral imbeciles; that is to say, persons in whose case there exists mental defectiveness, coupled with strongly vicious or criminal propensities, and who require care, supervision and control for the protection of others.

This last category of moral imbeciles is a purely administrative one. Medically there is nothing to distinguish the patient with arrested mental development who is sociable and tractable from the one who is vicious, impulsive, spiteful, or dangerously aggressive. The difference is in fact purely social, and may well derive to a considerable extent from the early handling, upbringing, and human relationships available to the patient in infancy and childhood. In some cases there may be specific disorders of brain function tending towards aggressive and impulsive conduct, since these may occur in mentally defective patients as in otherwise normal people; but essentially, the category is separately listed under the Mental Deficiency Acts purely to enable special provision to be made for the care of patients with this additional handicap.

Dementia is an aspect of insanity which is normally associated with structural damage, disease, or degeneration of brain and nervous tissue. It may be acute or chronic, depending upon the nature of the underlying structural disorder. It is characteristically distinguished by the following symptoms:

(a) Diminution of intellectual performance and capacity, with particular reference to the capacity for attention, concentration, and balanced judgment.

(b) Confusion in the patient's relationship with external reality; particularly in his orientation in time and space.

(c) The loss or failure of recent memory, with comparative retention of memory for earlier events in life.

(d) Blunting or excessive liability of emotional response.

(e) Comparable blunting or deterioration of behaviour, usually in the direction of apparently grosser, cruder, or more primitive habits.

Insight for all these aspects of deterioration may or may not be present in any particular case, but in either event the patient's capacity to convey

awareness of such deterioration may itself be impaired by the degenerative process.

Psychosis, or functional insanity, is a term which may be given to those forms of severe impairment of the patient's contact with and appreciation of reality which are not attributable either to mental defect or to structural degeneration of brain and nervous tissue. All forms of insanity therefore which exhibit such symptoms of mental disturbance in the absence of such structural immaturity or decay may come under this heading. Their separate description and diagnosis would be out of place in this chapter, and the reader is referred to textbooks of psychiatry for their elucidation.

It remains, however, helpful to have a few concepts of the principal types of symptoms which may be seen in any of the forms of insanity and these will be given here.

Depression of mood is obviously not necessarily a sign of madness, for it may be justified by the patient's life situation. However, it may appear without such apparent external justification, or it may be continued after some external catastrophe such as bereavement, or personal loss, or disaster, to a point where the patient is clearly no longer reacting in a normal way. If such depression cannot be recognized by the patient as without justification and cannot be modified or mitigated by any form of comfort or reasonable reassurance, it strongly suggests insanity. The importance of this lies in the fact that a depression which involves a divorce of the patient's judgment from reality is more than likely to induce a state of sufficient suffering and hopelessness to lead to suicide.

Exaltation or **pathological elation**, which must be distinguished from sheer excitement, represents the opposite kind of disorder of mood. Once again, when justified and normally short-lived, it may be clearly separable from any form of mental imbalance. But if not related to the reality of the patient's personal situation, it will again frequently be seen to overthrow judgment and lead to conduct which is truly insane.

Excitement and stupor are both essentially disturbances of conduct. We may presume in both cases that there is a corresponding underlying disturbance of mind, but often the patient is inaccessible to discussion or even emotional contact with others, and we can only proceed upon the basis of treating the condition as the patient's behaviour demands, bearing in mind the provisions mentioned above, that any action which is taken must be justified by being required for the safety and well-being of the patient himself, or for the safety and well-being of others. After recovery from excitement or stupor, the patient who was previously inaccessible may say that despite his inability at that time to communicate with others, or to modify his conduct, he was aware of what was going on, and may have been helped by the calmness and confident acceptance of his needs by those who dealt with him during his critical illness.

Examples will make these three descriptive terms clear. If a man believes that he has lost all his money, and is suffering from a fatal illness, despite the production of concrete evidence that he is still solvent, and has no demonstrable physical disease, then he is suffering from delusions. If he hears voices or sees visions which no-one else can hear or see, and which are in fact projections of his own fantasy, then he is hallucinated; while if he mistakes his physician or nurse for his father or mother, or for the devil come to take him away, then he is suffering from illusions, which are grafted on to the normal experience of seeing the people whose identity he misconstrues.

All these symptoms will be seen to have in common that severance that the patient's subjective experience from external reality which we have seen is characteristic of insanity. Under the influence of such severance from reality the patient's conduct is naturally disordered, and in this way his insanity may be made manifest. It remains important to realize that some forms of insane behaviour may be the outcome of purely temporary, acute, and short-lived confusion or delirium; for example in delirium tremens from the toxic confusional state produced after long addiction to alcohol: or from any of the other acute illnesses which may be accompanied by toxic confusional episodes. The importance to the patient and to the doctor of this recognition derives from the fact that it is never necessary to certify as of unsound mind the patient whose insanity is as short-lived and incidental to an acute physical illness as delirium or toxic confusional states of any kind.

Finally, the category of *moral insanity* has been put forward as a diagnostic entity, which has been called a disturbance of the upper levels of feeling and thought, not affecting the highest levels of intelligence. It is exemplified by the concept of the psychopathic personality. In fact careful examination of this proposition in practice leads to the conclusion that the individual's conduct, no matter how disturbed, does not in fact spring from a distortion of his subjective experience of reality. Such people are therefore not certifiable, and at present they remain to be dealt with by the law as responsible individuals, under the criteria at present existing for the recognition and definition of insanity in legal terms. Nevertheless the provision of special penal institutions for their care, after conviction, has now been proposed.

THE WORKING OF THE LAW IN RELATION TO INSANITY AND MENTAL DEFECT IN PRACTICE

"The English law is complex, both in civil and criminal cases, with regard to insanity. About eight different tests apply in civil cases, such as to wills, contracts, assignments, and other matters."[1]

Under the Lunacy and Mental Treatment Acts, 1890 to 1930, provision is made for the treatment of three classes of mental patients; namely (i) voluntary patients (ii) temporary patients, and (iii) certified patients.

(i) Voluntary Patients

Anyone *over* 16 years of age, who makes *written application to the person in* charge, may be received as a voluntary patient in any institution, as defined by the Mental Treatment Act of 1930, or in any hospital, nursing home or other place approved by the Board of Control, or as a single patient into the care of any person so approved. No medical practitioner need intervene.

A person not 16 years of age may be received as a voluntary patient, as above, only if his parent or guardian makes a routine application for the

purpose to the person in charge as above, accompanied by a recommendation from:—

(a) The patient's usual medical attendant, or

(b) One of the practitioners approved by the Board of Control.

A voluntary patient must be released within 72 hours of the receipt of a written request from himself, or, if under 16, from his parent or guardian. If a voluntary patient becomes worse, so that he can no longer express himself as willing or unwilling to remain, he must be discharged within 28 days, unless—

(a) he is sufficiently recovered to express willingness or unwillingness to stay.

(b) He has been recommended according to the method described below as being likely to benefit by temporary treatment.

(c) He has been certified as of unsound mind.

(ii) Temporary Patients (without certification)

If a patient suffering from mental disorder is incapable of expressing himself as willing or unwilling to receive treatment, and is likely to benefit by temporary treatment, he may be received by written application by a relative or by a duly authorized officer of the local authority, but without certification, into a mental or registered hospital or other institution or nursing home approved by the Board of Control, or under charge as a single patient with the consent of the Board of Control.

The application must be accompanied by a recommendation signed by two medical practitioners, one if possible being the patient's usual medical attendant, the other one being one of the practitioners approved by the Board of Control. These practitioners may examine the patient either conjointly or separately within five days of each other, and their recommendation holds good for 14 days only.

Such patients may be retained for six months; and if early recovery seems possible, for two further periods of three months, but not exceeding 12 months in all. If meanwhile the patient becomes capable of expressing himself willing or unwilling to receive treatment, he may not be detained against his will for more than 28 days, unless in the meantime he has again become incapable of expressing himself as willing or unwilling to receive treatment.

Adequate security is provided by the Statute for visiting and supervising these patients.

(iii) Certified Patients

Although final disappearance from the world is no longer the fate of a certified patient who is sent to a mental hospital, certification involves the loss of a good deal of that personal liberty which in English law is the right of every man, and is guarded by the third of the four principles set out on page 545. Moreover, there is the stigma of being officially declared to be a person of unsound mind which may remain as an unwelcome legacy to the family; it is therefore no light matter to certify a person as insane and to cause him to be received into a mental hospital. "Good faith and reasonable care" on the part of the certifier are required here in a greater degree than is necessary, perhaps, anywhere else in the activities of a medical practitioner.[1]

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[1] In a case where damages were claimed against two medical practitioners for alleged negligence in certifying a mental case, Lord Justice Scrutton referred to the duty of the courts to hold the balance fairly between the desire to protect the liberty of the subject on the one hand, and, on the other, the desire to protect the physicians who are called upon by Parliament to exercise for the good of the community the duty of honestly expressing their opinion about patients (*Brit. med. J.*, 1929, **11**, 1226).

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[1] Mr. Justice McCardie in R. v. True.

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When considering the question whether or not a person should be certified, two interests should be borne in mind; viz. (a) that of the physician who is asked to certify, and (b) the interests of the patient.

These are dealt with in order.

The Interests of the Medical Man. The following sections of the Lunacy Act, 1890, show the responsibility and liability of a medical man who is asked to certify a person as a person of unsound mind:—

"Sec. 28. (2) *Every medical certificate upon which a reception order is founded shall state the facts upon which the certifying medical practitioner has formed his opinion that the alleged person of unsound mind is a person of unsound mind, distinguishing facts observed by himself from facts communicated by others; and a reception order shall not be made upon a certificate founded only upon facts communicated by others.*

"(3) *The medical certificate accompanying an urgency order shall contain a statement that it is expedient for the welfare of the alleged person of unsound mind or for the public safety that he should be forthwith placed under care and treatment, with the reasons for such statement.*

"(4) *Every medical certificate made under and for the purposes of this Act shall be evidence of the facts therein appearing and of the judgment therein stated to have been formed by the certifying medical practitioners on such facts, as if the matters therein appearing had been verified on oath.*

"Sec. 29. (1) *A reception order shall not be made unless the medical practitioner who signs the medical certificate, or where two certificates are required, each medical practitioner who signs a certificate, has personally examined the alleged person of unsound mind in the case of an order upon petition not more than seven clear days before the date of the presentation of the petition, and in all other cases not more than seven clear days before the date of the order.*

"(2) *Where two medical certificates are required, a reception order shall not be made unless each medical practitioner signing a certificate has examined the alleged person of unsound mind separately from the other.*

"(3) *In the case of an urgent order, the person of unsound mind shall not be received under the order unless it appears by the medical certificate accompanying the order that the certifying medical practitioner has personally examined the alleged person of unsound mind not more than two clear days before his reception.*

"Sect. 317. (1) *Any person who makes a wilful misstatement of any material fact in any petition, statement of particulars, or reception order under this Act, shall be guilty of a misdemeanour.*

"(2) *Any person who makes a wilful misstatement of any material fact in any medical or other certificate, or in any statement or report of bodily or mental condition under this Act, shall be guilty of a misdemeanour.*

"(3) *A prosecution for a misdemeanour under this section shall not take place except by order of the Commissioners, or by direction of the Attorney General or the Director of Public Prosecutions.*

Act or any Act amending this Act, he shall not be liable to any civil or criminal proceedings, whether on the ground of want of jurisdiction or on any other ground unless he has acted in bad faith or without reasonable care.

"(2) *No proceedings, civil or criminal, shall be brought against any person in any court in respect of such matter as mentioned in the last preceding subsection, without the leave of the High Court; and leave shall not be given unless the court is satisfied that there is substantial ground for the contention that the person against whom it is sought to bring the proceedings has acted in bad faith or without reasonable care.*

"(3) *Notice of any application under the last preceding subsection shall be given to the person against whom it is sought to bring the proceedings, and that person shall be entitled to be heard against the application.*

"(4) *Where on an application under this section leave is given to bring any proceedings, and the proceedings are commenced within four weeks after the date on which leave was so given, the proceedings shall for the purposes of the Public Authorities Protection Act, 1893, be deemed to have been commenced on the date on which notice of the application was given to the person against whom the proceedings are to be brought.*

"*Sect. 331.* (1) *Any action brought by any person who has been detained as a person of unsound mind against any person for anything done under this Act shall be commenced before the expiration of one year from the release of the party bringing the action, and shall be laid or brought in the county or borough where the cause of action arose, and not elsewhere. (See the Limitation Act, 1939, S.21)*

"(2) *If the action is brought in any other county or borough or is not commenced within the time limited for bringing the same, judgment shall be given for the defendant.*"

restrain or control a patient in emergency. Failure to obtain such an authorization has placed a medical man in a position of difficulty. Section 40 ("Mechanical Restraint") of the Lunacy Act, 1890, should be read in this connection.

In *Harnett* v. *Fisher* the jury found that at the date when Dr. Fisher certified Harnett the patient was not of unsound mind and that Dr. Fisher had not acted with reasonable care, and they awarded £500 damages. The House of Lords held that the Limitations Act, 1623 applied; and that in view of the finding of the jury, Harnett *could not maintain within the disability* section of the Statute of 1623, that he was *non compos mentis* during his *detention; and that consequently the action was barred six years after the* date of the certificate.

By Sect. 16 of the Mental Treatment Act, 1930, a medical practitioner who signs a reception order or certificate, shall not be liable to any civil or criminal proceedings unless he has acted in bad faith or without reasonable care; and by the same section, no such proceedings shall be instituted without the leave of the High Court, and such leave shall not be given unless the Court is satisfied that there is substantial ground for instituting the said proceedings.

The Interests of the Patient. To quote those sections of the Act which bear on this aspect of our question would be to print nearly the whole of the Act of 1890, for that Act was passed in these interests, viz., to ensure that the lot of a certified patient should be more reasonably comfortable. Whereas it was formerly the main object to put a certified patient out of sight, the object now is to restore him to health.

There is no doubt that every person of unsound mind ought to be taken care of; but between being taken care of and being certified and placed in a mental hospital as a certified patient, there are many grades of management which *have now been recognized and provided for* by Parliament in the Mental Treatment Act, 1930 (supra). There are many harmless patients who are well managed, nursed, looked after, and treated in their own homes and by their own friends, and in respect of whom unless payment is made for their care, the formality of certification is unnecessary and undesirable, unless suspicion arises that they are not being fairly treated.

The real crux of the problem concerning the interests of the patient arises from those portions of the Lunacy and Mental Treatment Acts, 1890 to 1930, which deal with single cases and with unlicensed houses, and in respect of those patients who, while not strictly certifiable, undoubtedly require care and protection on grounds of expediency. It remains vital that the criterion justifying such expediency should be their own convenience, and not that of others. [See Mental Treatment Act and subsequent Statutory Instruments (Nos. 1071 of 1948) for provisions as to voluntary and temporary patients.]

In this connexion, the following sections of the Lunacy Act, 1890, are relevant:—

"*Sect.* 315. (1) *Every person who, except under the provisions of this Act, receives or detains a person of unsound mind, or alleged person of unsound mind, in an institution for persons of unsound mind, or for payment takes charge of, receives to board or lodge, or detains a person of unsound mind or alleged person of unsound mind in an unlicensed house, shall be guilty of a misdemeanour, and in the latter case shall also be liable to a penalty not exceeding £50.*

"(2) *Except under the provisions of this Act, it shall not be unlawful for any person to receive or detain two or more persons of unsound mind in any house unless the house is an institution for persons of unsound mind or workhouse.*

"(3) *Any person who receives or detains two or more persons of unsound mind in any house, except as aforesaid, shall be guilty of a misdemeanour.*"

It is under these sections that proceedings against medical practitioners are taken in the rare cases which now occur.

How can a Certified Patient be Received into a Mental Institution?

The Lunacy and Mental Treatment Acts, 1890 to 1930, provide for the care and treatment of persons of unsound mind; and the Mental Treatment Act, 1930, made drastic and far reaching changes in the law for the institutional and other treatment of persons suffering from mental disorder (see p. 550 *supra*). The Mental Treatment Rules, 1930 and 1948, supersede all previous Rules made by the Board of Control.

Whatever may be the social position of a certified patient (in contradistinction to a voluntary or temporary patient) or whatever the nature of his mental derangement, except he be an idiot (*vide* next paragraph), he can be received into a mental hospital or institution only upon a reception or urgency order. Of this order must be noted:—

1. Its varieties.
2. Who must sign it?
3. What documents must accompany it?
4. How is it to be obtained?

(Mental defectives are dealt with by separate enactments, viz., the Mental Deficiency Acts, 1913 to 1938).

For the sake of clearness, the orders for reception may be tabulated, as follows.

ORDERS FOR RECEPTION

Variety	Signed by	Accompanying Documents	How obtained	Remains in force
1. Urgency. Lunacy Act, 1890, S.11, N.B. This section is now of general application	If private, nearest relative (if possible). If Health Service patient duly authorized officer of local authority	Statement of particulars. One medical certificate	By signing the order	Seven days only from date of order unless petition pending
2. On petition, Section 4	Specially appointed justice	Statement of particulars. Two medical certificates	By presenting a petition from relatives	
3. Summary reception order, Section 14	A Justice of the Peace	Statement of particulars. One medical certificate	Information from a duly authorized officer	For one year. Must then be renewed. 2
4. Order for a person of unsound mind wandering at large, Sec. 13	A Justice of the Peace	Statement of particulars. One medical certificate	Information from a duly authorized officer or constable	
(This includes procedure under so called three day order q.v.)				
5. Order by one Commissioner, Section 21	One Commissioner	One Medical Certificate	On the initiative of one of the Board of Control	
6. After Inquisition, Section 90	Committee or Master	Office copy of order appointing Committee or order of Master	Upon application to the Court	Until superseded

DEFINITION OF TERMS USED IN THE TABLE

(a) "The Judicial authority" is defined in the Act of 1890, Section 9, to be a justice of the peace specially appointed for the purpose, or a judge of county courts, or a magistrate. List of judicial authorities are published.

(b) "Statement of Particulars." This is the formal document, Form 2 (of which printed copies can always be obtained from the place to which it was proposed to send the person), which sets out precisely the name and previous history of the patient—in other words, the particulars of the case up to the present attack.

(c) Committee[1] of the Person. When once a patient has been found by inquisition to be of unsound mind, a committee of his person may be appointed. A committee has sole control of person or estate, or both, subject only to the authority that appointed him, to whom he must make periodical reports.

Urgency. This implies that there is a danger that, if the patient be not speedily placed under control, some serious damage may result either to the patient, or to those taking care of him, or to the public (e.g., in a hotel, ship, boarding-house, etc.), and this must be made clear in the certificate.

To prevent abuse of such great powers over the person, the law requires:—

(i) that in the case of a private patient, the person signing such order shall be the nearest relative, (or if not, that very good reasons shall be given why such person does not sign); and in the case of a Health Service patient, the order must be signed by a duly authorized officer of the local authority;

(ii) that the person signing must be 21 years of age, and therefore can be made fully responsible for his actions;

(iii) that the person signing must have seen the patient within two days—a measure of the urgency of the case. The order remains in force seven days only, unless in the meantime the more ordinary means for restraining the patient (petition usually), have been at least initiated, and then the order remains in force until the completion of the petition.

Inasmuch as it will most frequently be upon a medical man that the responsibility for the urgency order will rest, a few words of advice are added. Urgency may arise in connection with acute mania, and this is of two kinds:

(i) that attributable to distinctly recoverable causes such as alcoholic and other toxic conditions, deliriant poisons, acute pyrexial disease, etc.;

(ii) that attributable to no apparent removal cause—i.e., purely mental in origin, so to speak; hence the need to endeavour to ascertain the cause of the outbreak.

Two sound general rules apply: –

(1) Avoid certification in cases of acute deliria, which can always be tided over without it.

(2) Obtain from a responsible friend or relative a *guarantee against future proceedings or expenses*, whenever the patient appears potentially litigious.

In the eyes of many people, certification as a person of unsound mind inflicts a stigma which can never be removed, and remains for the life of the patient and as a legacy to the children and relatives; every possible chance of simple nursing and watching which the circumstances of the case permit should, therefore, be exhausted before taking the serious step of "certifying". In these cases the law affords to the medical men comparatively little protection; and, if the patient recovers (as not infrequently happens in cases of delirium tremens, etc.), the certifying physician may have great difficulty in proving that he exhausted every other possibility before certifying, having regard to the welfare of the patient, and the safety of the public.

[1] This word is spelled like Committee, but is pronounced Komité.

Petition. This is the most usual course when dealing with patients where "urgency" is not pleaded. The petition must be signed by the nearest relative, or a valid reason given for the fact that some one else has signed it; the person signing must be 21 years of age, and must have seen the patient within 14 days. Together with the accompanying documents shown in the table, it must be presented to a judicial authority, who thereupon considers the allegations of the petition, the statement of particulars, and the evidence of insanity appearing on the medical certificates, and whether it is necessary for him to see and examine the person of alleged unsound mind; and if he is satisfied that an order may properly be made forthwith, he makes it. If not satisfied, he appoints a time, not more than seven days after the presentation of the petition, for its consideration; and in the meantime he may make inquiries. If he is not satisfied with the evidence of insanity appearing on the medical certificates, he may also visit the person of alleged unsound mind.

When the petition is considered, this takes place in private, and no one, except with the leave of the judicial authority, is allowed to be present except the petitioner, the person alleged to be of unsound mind (unless the judicial authority shall in his discretion otherwise order), any one person appointed by the person of unsound mind for that purpose, and the persons signing the medical certificates; and all, except the person alleged to be of unsound mind and his nominee, are bound to secrecy. The judicial authority may dismiss the petition, giving his reasons to the petitioner in writing, and must send a copy to the Board of Control; or he may adjourn the consideration for not more than 14 days; or he may make the *reception order*, on the strength of which the person of unsound mind may be admitted into an institution, or be received into a house as a single patient.

Summary Reception Order

"If a duly authorized officer of the local health authority:—

(a) has reasonable ground for believing that a person in the area of the authority is a person of unsound mind and a proper person to be sent to a mental hospital; and

(b) is satisfied that he is not under proper care and control, or that there are no relatives or friends who intend and are able to take proceedings by petition for a reception order under the foregoing provisions of this act; he shall, within three days, give notice thereof to a justice having jurisdiction in the place where the said person is."

Such judicial authority shall direct one medical practitioner to examine the patient, and, if necessary, to certify him as insane, and shall then proceed as if a petition had been presented to him. The duly authorized officer may be said to take the place of a petitioner in ordinary cases.

Persons of Unsound Mind wandering at Large

"A constable or duly authorized officer shall apprehend such wanderer, either on his own initiative or by order of a justice", and may then convey him to an observation ward. The wanderer may be detained in the observation ward not longer than three days, if his welfare or the public safety demand it, without the order of a justice, a modified proceeding which must be replaced by proper inquiry by the end of the three days. Thereafter the procedure may be either that of a reception order on petition, if the relatives are found subsequently to be available and prove willing, or a summary reception order if they are not. In the latter event, the justice may suspend

execution of such an order for not more than 14 days if he sees fit, to allow time for further examination or enquiries, or the possible improvement or recovery of the patient's condition.

The action of the duly authorized officer in removing the patient to an observation ward, is sometimes referred to as a three day order: under its general provisions, any doctor may call in the duly authorized officer in emergency, to deal with a patient of unsound mind.

Beyond the maximum period of 14 days specified above, a person of unsound mind cannot be legally detained except as a temporary patient or by judicial order; and such detention must be either in a licensed house, a registered hospital, a mental hospital, or as a single patient; in all of which circumstances the Board of Control is bound to inspect from time to time.

If a patient admitted under an order upon petition has not been seen by a judicial authority before the reception order is made, he is entitled to be given notice of his right to an interview (sect. 8.); and notice that he is so entitled must be given within 24 hours after his reception, unless the medical officer certifies within the same period that such interview would be prejudicial to the patient's welfare.

All the above processes are concerned with the person only of the patient. The method by which the property as well as the person of a patient may be taken care of, if necessary, is by inquisition.

Inquisition. Prior to the Lunacy Act 1890, this process was confined almost entirely to the rich. It was always an expensive procedure, but that Act has modified the position materially by entrusting to the judge, to the master and to the Board of Control much wider powers in regard to procedure.

Sect. 116, sub-section (1) of the Lunacy Act, 1890, makes the judge in lunacy the trustee of all the property of all persons found insane; (paras. (a), (c), and (f), and sub-sects. (d) and (e) simplify the "finding of insanity" by requiring it merely to be to the satisfaction of the judge "by affidavit or otherwise" for purposes of protecting property without reference to the care of the person, which is not dealt with by this section).

Position of Mental Patients possessed of Property other than those found Insane by Inquisition

The Management and Administration Department (formerly known as the Office of the Masters in Lunacy) is concerned with the management and administration of the property of all persons who are mentally incapable of managing their affairs.

The object is to afford protection to such mental patients (including Mental Defectives) during their illness. This protection extends to all patients possessed of property—

(a) Whether under treatment in Mental Hospitals or other Institutions under the Lunacy or Mental Deficiency Acts; or,

(b) Whether under treatment in single care; or,

(c) Residing in their own homes or elsewhere although not under certificate.

It is provided by the Lunacy and Mental Treatment Acts of 1890 to 1930 that a receiver of the patient's property may be appointed in any case where there is proof that, although he is not under treatment as a person of unsound mind, the patient is, through mental infirmity arising from disease or age, incapable of managing his affairs.

Powers of Attorney. Where a patient is possessed of property and is mentally incapable of managing his affairs, he is not in a position to give any power of attorney or other authority to manage his property; and any such authority so given is invalid and any such authority given prior to his illness becomes inoperative by reason of such incapacity. Any person continuing to act under any authority so given, or any bank or company in which the patient has money who permits any dealings with the same with knowledge of the patient's mental illness incurs considerable risk.

Receiver. Until a receiver is appointed there is no one in a position to give a discharge on behalf of the patient or to manage his property. The proper course, therefore, is to consult the Department as to the correct course to pursue in the particular circumstances and as to the necessity for the appointment of a receiver to act in the name of and on behalf of the patient.

It may well be that in certain circumstances proceedings for the appointment of a receiver may not be insisted upon, e.g., where trustees of a will or of a settlement under which the patient benefits have an absolute discretion to apply the income (or capital) of the trust fund for the maintenance and benefit of the patient during incapacity; but even in this class of case it is *sometimes necessary to enquire on behalf of the patient as to how this discretion is being exercised.*

Cases frequently occur where someone has been acting under an authority given by the patient prior to or since his incapacity, and subsequent investigation shows that either the property of the patient has not been managed in a satisfactory way, or that the patient has not been maintained in a manner suitable to his means and position. Again, experience goes to show that the realization by the patient that his property is being protected often removes a source of worry.

The procedure has been greatly simplified, and a Personal Application Division has been established.

DETAILS OF CERTIFICATION

The Medical Certificate

The certificate is as follows:—

<div style="text-align:center">

Certificate of Medical Practitioner
(33 Vict. C. 5. Sched. 2. Form 8.)

In the matter of

</div>

(a) Insert residence of patient	of (a)
(b) County, city, or borough as the case may be	in the (b)
(c) Insert profession or occupation, if any	(c) an alleged person of unsound mind I, the undersigned, do hereby certify as follows:— 1. I am a person registered under the Medical Act, 1858, and I am in the actual practice of the medical profession.

(d) Insert the place of examination, giving the name of the street, with number or name of house, or should there be no number the Christian and surname of occupier.

(e) County, city or borough, as the case may be.

(f) Omit this where only one certificate is required.

(g) An idiot, or a person of unsound mind.

(h) If the same or other facts were observed previous to the time of the examination, the certifier is at liberty to subjoin them in a separate paragraph.

(i) The names and Christian names (if known) of informants to be given, with their addresses and descriptions.

*Or not to be

(k) Strike out this clause in case of a patient whose removal is not proposed.

(1) Insert full postal address

2. On the   day of   I at (d)
in the (e)   of
(separately from any other practitioner)
(f) I personally examined the said
and came to the conclusion that he is (g)
and a proper person to be taken charge of
and detained under care and treatment.

3. I formed this conclusion on the following grounds, viz:—

(a) Facts indicating Insanity observed by myself *at the time* of examination (h) viz:—

(b) Facts communicated by others (i), viz:—

4. The said
appeared to me to be *
in a ill condition of bodily health to be removed to a mental hospital, or licensed house (k).

5. I give this certificate having first read the section of the Act of Parliament printed below.

(Signed)

of (1)

Dated this   day of   1

An important footnote is thus given—

Any person who makes a wilful misstatement of any material fact in any medical or other certificate, or in any statement or report of bodily or mental condition under this Act shall be guilty of a misdemeanour—
Extract from Sec. 317 of the Lunacy Act, 1890.

(53 Viet. C. 5. ss. 4, 11, 16, 28, 29)

In this certificate there are several points which require to be mentioned specially, as inattention thereto has been the cause, frequently, not only of the certificate being returned for emendation—a small but annoying matter (*experto crede*)—but also of much more serious trouble to medical men in the form of legal proceedings.

1. As a general statement it must be remembered that at the beginning of the proceedings the petition, and the circumstances in which it is presented, the "statement of particulars", and the medical certificates are, as a rule, the only evidence which a judicial authority or a Commissioner possesses as to the mental condition of a patient, or even as to the existence of such a person. For these reasons, verbal accuracy in spelling is essential; it may seem absurd to have a certificate returned for the insertion of a final "e" in Smythe, for instance, yet such might prove to be a serious error; and if proper names were permitted to be spelt wrongly, it would not be possible to draw the line anywhere.

2. When two certificates are required, (a) each must be made and signed *as the result of an interview made separately from the other certifying medical practioner*, i.e., at a different time: (b) the two medical men must not be relatives or business partners of one another: (c) if possible one must be signed by the patient's usual medical attendant.

3. Each certificate must be made and signed by a medical practitioner himself, not by his substitute; at least if a substitute does so make and sign it. he must be a registered medical practitioner, and must by so making and

signing *assume to himself and not to his principal* full responsibility for all that he states (Sects. 28 to 34).

4. In petitions, the medical practitioner who signs the certificate must be neither a relative nor a business partner of the petitioner.

5. In any and all cases the medical practitioner who signs a certificate of insanity, must not be interested pecuniarily in the place (institution or private house) to which the patient will be sent; and he should not be related in any way to the medical superintendent.

6. The certifier cannot remain the medical attendant of (or on) the patient after certification; if a medical practitioner wishes·to become or to remain the medical attendant of a patient, he must obtain an independent medical practitioner to certify the case.

7. In commissions of inquiry the evidence of a medical witness is similar to that which would be written in a certificate; but it is obtained on the compulsion usual in courts of law, and is consequently privileged: therefore, so long as the facts are correct, a witness may advance any theories he may please without fear of an action for defamation. If such theories are to have any weight, they must be strong enough to bear very close cross-examination; and must be unbiased by any personal feeling or motive.

8. The basis of the certificate is the "facts". But a medical practitioner must not be ready to sign certificates for the restraint of persons who may be labouring under harmless delusions. In violent mania, or in insanity with a homicidal or a suicidal propensity, there can be no doubt of the propriety of applying some degree of restraint. If a remarkable change in the conduct of the patient has suddenly taken place, if he has become irritable, outrageous, or has threatened personal violence, or if he has recklessly endangered the interests of himself and his family, he is undoubtedly a fit subject for restraint. The more he approaches to this condition, the less difficulty there is in coming to a decision; and in a really doubtful case there will be no impropriety in employing restraint.

The words "Facts indicating insanity observed by myself", are not always properly appreciated or even understood by many medical men. Frequently the facts are stated in a loose and careless manner, indicating that there is a complete *misapprehension of their meaning*. *What is required by the law* is a statement of *facts* observed or witnessed by the medical man himself *at the time of examination*, which would carry conviction to the mind of any non-professional man who reads it, that the person to whom it referred was of unsound mind. *In all cases a medical man should avoid giving as a fact indicating insanity any delusion which may have some foundation in truth.* In regard to the second requirement of the statute, i.e., "Other facts (if any) indicating insanity communicated by others", although these do not supersede the facts observed by the medical man himself, they are of great importance in throwing light upon the propensities or habits of the patient, and of recent alterations in habits and conduct. A medical man must take care to draw a clear distinction between the facts observed by himself and those communicated to him by others, and also the facts observed by himself at the time of examination and those observed previously; and he should avoid such vague expressions as "I think", "I believe", etc.

No medical man is compelled to take upon himself the responsible duty of signing certificates of insanity; but if he does undertake it, he must perform it with reasonable care and ordinary skill. If he certifies that a person is labouring under delusions, illusions, or hallucinations, he must take care that he understands the meaning of the terms, and he should describe them; and, assuming that he is correct in believing from his own observation that such things exist in the mind of the patient, *it must be remembered that, in order to justify certification, the law always looks to the influence of these delusions, etc., upon conduct.*

As an example, two cases of delusional insanity may be considered. In one, a woman believes that she is appointed to save mankind, and that all her daily actions are recorded and broadcast on the television for the delectation and education of others. She continues meanwhile to lead a sober and exemplary life, and, although this delusion is firm and unshakeable, it does no harm, and need not be the basis of certification at all, unless at any time it begins to affect her conduct in a way which brings her into conflict with others, or leads her to require care and protection for her own welfare.

In another case a man believes his wife is being unfaithful to him, with all the tradesmen, every day. Whether or not he has any grounds for suspicion of his wife's fidelity, the extravagant nature of this particular belief makes it probable that it is a delusion. When there is added to it the man's further statement that he knows that his wife is being unfaithful to him with all the tradesmen because there are a number of unseen voices which keep him informed about her movements even when he is at work, which are transmitted to him by secret agents using thought waves, and when he further adds to this the statement that he can tell that his wife has been unfaithful when he returns because the colour of her skin changes at these times, then one can accept that in addition to delusions he is suffering from hallucinations and illusions. Since delusions, hallucinations and illusions of this kind are frequently associated with *murderous attacks upon the wife so suspected*, this would be a case where certification might well need to be considered. In this connection reference should be made to the provisions of s. 16 of the Mental Treatment Act, 1930, as to the burden of proof in cases of alleged unreasonableness in certification.

Discharge of Certified Patients

One of the commonest and most distressing misconceptions in the public mind about certification is that once a patient has been certified it is impossible for his relatives to get the certification withdrawn, at least without a great deal of difficulty and passage of considerable time. This is quite untrue, and in fact the petitioner or, if he or she is no longer capable for any reason, his or her duly appointed substitute, may discharge a patient simply by requesting the withdrawal of certification, provided that the medical officer who has the power to veto discharge in these cases does not oppose the discharge under Section 72 of the Lunacy and Mental Treatment Acts. In fact the only reason for which discharge is ever opposed is if, in the opinion of the medical officer, there remains some risk to the patient or to others if he is discharged from hospital. *The readiness with which a petitioner may procure discharge of a patient whose certification he has petitioned would, if widely known, immensely reduce the reluctance and apprehension with which so many sincerely affectionate relatives approach the duty of signing the petition.* Reassurance on this point can and should be given in most emphatic terms by their medical adviser.

The Board of Control has similar power to release a patient, subject to the same veto (Section 72 (3)); but the petitioners of the Board of Control have absolute power to order the discharge of a patient in a hospital or licensed house, or of a single patient subject to certain consents (Section 75).

The person who has charge of a person of unsound mind may liberate him on probation; but this power does not extend to a person of unsound mind so found by inquisition.

Inquisition may be superseded; but the evidence must then be as strongly in favour of sanity as previously it was in favour of sanity.

Sects. 101 to 106 of the Lunacy Act, 1890, prescribe the means and powers of traversing or superseding an inquisition.

The Committee of a person of unsound mind so found by inquisition may discharge the patient by an order under his hand accompanied by an office copy of the order appointing him committee.

By Sect. 49 of the Lunacy Act, 1890, any person may apply to the Board of Control for a mental patient in an institution or in single care, to be examined by two medical practitioners; and if they certify that the patient may be discharged without risk of injury to himself or the public, the Board may order his discharge.

It would seem that only a Secretary of State has power to release a Broadmoor patient.

In deciding whether a patient who has been certified and is in a mental hospital is now fit for discharge, the particulars of his case should be examined with the same caution and attention to detail as if he were being considered as a possible subject for certification for the first time.

In accordance with the general principle already enunciated, it is obviously desirable to discharge a patient from a mental hospital and from certification at the earliest moment compatible with his health and well-being and the well-being and safety of others. In practice this is not usually a very difficult decision when the patient has been admitted to a mental hospital purely on account of his illness; it may, however, become an extremely difficult and responsible decision if the patient, in the course of illness and prior to certification, had been driven by his symptoms to act in a way threatening or dangerous to others or to himself. Cases can be quoted where patients who have been certified after a suicidal attempt have appeared to be well, only to complete the act of suicide after discharge. A case occurred in my own experience where a patient, who had been admitted to a mental hospital under certificate for schizophrenia, received treatment for several months, appeared to have recovered, and was discharged, only to murder a man completely unknown to him some two weeks later by suddenly pushing the victim in front of an oncoming tube train. When subsequently examined, he had clearly relapsed into a state of profound insanity.

A doctor cannot always be responsible for unfortunate consequences of this kind; indeed in some degree he must always accept a calculated risk when he discharges a patient who has shown marked suicidal tendencies. But the instances quoted above illustrate how particularly careful such a doctor needs to be when considering the discharge of a patient *who has threatened or proved to be dangerous to others, or who has been guilty of a crime of violence in connection with his illness.*

As a general rule it is wise to be extremely cautious about permitting a certified patient to return, after recovery, to precisely those circumstances in which his conduct first became abnormal and then necessitated certification, and this applies whether the circumstances were related to business strain; which is liable to recur or continue, to personal worries connected with external circumstances, or to a domestic relationship in which an element of strain persists.

Escape of Certified Patients

If a certified patient escapes from hospital and succeeds in remaining at large for more than 14 days, the whole process of certification must be repeated before he can again be placed under restraint. (Sections 85 and 89). If a Broadmoor patient escapes, he is of course liable to be returned to Broadmoor, or to some other appropriate mental hospital, at any time, no matter how long he has remained at liberty, always providing that he was committed to Broadmoor or some other mental hospital under certificate after being convicted of a criminal offence. If he was committed to Broadmoor because he had been found unfit to plead by reason of insanity, or insane on arraignment, then following escape he can be returned to court to stand trial, if his mental condition appears to have changed for the better.

Legal Position of Certified Patients with Regard to Treatment

Patients under certificate may legally be subjected to any form of medical treatment considered advisable by the Medical Superintendent of the hospital in which they are being cared for, even without their consent and against their will. This principle does not mean, of course, that every attempt should not be made to gain the patient's co-operation and understanding in the acceptance of treatment, and its aims. But in practice Medical Superintendents can and frequently do cause to be administered such forms of physical treatment as electroplexy, deep sedation, and various forms of insulin therapy, even without the consent of the patient if this cannot be obtained. The administrative restrictions which are applied to the use of any form of mechanical restraint (now in practice virtually abandoned in all British Mental hospitals) do not apply to the administration of physical treatment.

However, in the case of such irreversible and comparatively experimental methods of treatment as leucotomy, and the various forms of surgery of the brain for mental disorder, Medical Superintendents tend naturally to be extremely reluctant to advise or undertake operation if the patient himself expresses determined opposition to the procedure. Legally, it would seem that leucotomy might be performed upon a certified patient, despite his refusal. But, as has been indicated, such a step would have to be justified ultimately on moral and ethical grounds rather than upon purely legal provisions, if indeed it could be justified at all.

The Mental Deficiency Acts, 1913 to 1938

We have already quoted the definitions contained in section 1 of 1913 (as amended by the Act of 1927). (*vide* p. 548.)

Section 3. Two medical certificates are necessary in placing a defective under control in a certified institution or house when a parent or guardian takes action.

Section 5. A petition presented to a judicial authority by a relative or friend or the parent or guardian also requires two medical certificates or a certificate that a medical examination was impracticable.

Section 8. Where it appears to a court of summary jurisdiction that a person convicted of or charged with an offence is a defective, the court may order him to be detained in an institution for defectives or be placed under guardianship.

Section 9. Where the Secretary of State is satisfied from the certificate of two duly qualified medical practitioners that any person who is undergoing imprisonment (except under civil process) or penal servitude . . . is a defective, he may order his transfer to an institution for defectives.

Section 11. An order sending a defective to an institution or placing him under guardianship shall remain in force for a year after the date of expiry thereof, and thereafter for successive periods of five years, if at that date and at the end of each period of one and five years respectively the Board of Control, after considering the special reports and certificate mentioned in the Acts of 1913 to 1938, and the report of a medical practitioner who has made a medical examination of the defective, consider that the continuance of the order is desirable.

Section 16. In respect of a mental defective detained in an institution the consent of the Board of Control is necessary before steps are taken to remove him to a mental hospital.

These Acts are not of much medico-legal interest, unless a medical man be placed in charge of a defective or of a licensed institution for defectives; but in this event he will need to study the Act very carefully, including the more recent regulations,[1] which embody certain changes consequent upon the inception of the National Health Service.

RESPONSIBILITY OF THE INSANE

This may be divided into civil and criminal responsibility. Inasmuch as the law presumes that every man is sane until he is proved insane, there is no subject in legal medicine which has given rise to greater controversy than the fixing of the degree and form of insanity which shall free a person from a contract which he has entered, or from the consequences of a wrongful act which he has committed.

Judging from recent decisions of the courts, it would seem that the question of the *civil* responsibility of the insane is as far from being settled satisfactorily as it has ever been; so far as regards *criminal* responsibility, however, a dictum exists, and is dealt with below.

The subject of responsibility will be considered in the following order: (i) Competency of a person of unsound mind as a witness; (ii) Insanity and marriage; (iii) Insanity and contracts; (iv) Insanity and torts; (v) Testamentary capacity; (vi) Criminal responsibility.

[1] Statutory Instrument N. 1000, Mental Deficiency Regulations, 1948.

(1) Competency as a Witness

A question of some importance has from time to time arisen in regard to the admissibility of the evidence of a person of unsound mind concerning facts alleged to have been witnessed by him.

The degrees of insanity are infinite; some persons of unsound mind are as fully competent as sane persons to observe and to remember facts, and to understand the obligations of an oath; it follows, therefore, that incompetency to give testimony must not be inferred from a mere name assigned to the malady from which a person is suffering; but it must be decided by the special condition of the patient. Under any other view, serious crimes might be openly perpetrated in mental institutions without the possibility of convicting the offenders. Incompetence to testify is not necessarily connected with insanity; it would be far more correct to regard it as an independent fact to be separately proved. A false parallel has in fact been drawn between giving evidence and performing business contracts and other civil acts; and, in consequence, the former has been placed with the latter in the same category of disqualification without an attempt to ascertain the kind and degree of intellectual power which these acts respectively require.

In R. v. Hill the evidence of a man named Donnelly was tendered on the part of the Crown. This man was a rate-aided person of unsound mind, and as such was confined in the same ward as the deceased, who, it was alleged, had been maltreated and killed by the prisoner. It was quite clear from the examination o Donnelly at the trial that he laboured under insane delusions that he was constantly visited by spirits, etc.; nevertheless, he gave a clear and consistent account of the manner in which the deceased was maltreated by the prisoner; and although he expressed his firm belief in the existence of spirits and their secret power of communicating with him, he appeared to have a full knowledge of the difference between truth and falsehood. His evidence was received; and, upon this, the prisoner was convicted.

Subsequently the case was argued upon appeal before all the judges; and they decided in favour of the admissibility of the evidence. It may, therefore, be considered and settled that a person of unsound mind who suffers from delusions, but in the opinion of the judge, upon the evidence of a medical practitioner, is capable of giving an account of a transaction which happened before his eyes, and who appears to understand the obligation of an oath, may be called as a witness. Before he is sworn, the person of unsound mind may be cross-examined, and witnesses called to prove circumstances which tend to show that he is incompetent to give evidence; but, in the absence of such evidence, and upon such medical evidence as is indicated above, the person of unsound mind may be allowed to give evidence; and it must be left to the court to measure the value of his testimony.

Exactly the same principles apply to persons suffering from mental defect, whose evidence may be considered by a court; with this further condition, that an idiot is regarded in Common Law as a person who from birth has had no mind, and is, therefore, incapable of giving evidence. Mentally defective persons above the category of idiots are assessed in precisely the same way in respect of their competence to testify, as is anyone else of unsound mind

Insanity is an impediment to marriage, because an insane person cannot give that rational consent which is necessary to the validity of a contract. The marriage of a person of unsound mind so found by legal inquisition is null and void to all intents and purposes whatsoever even though it may have been celebrated during a lucid interval.[1] In the case of a person of unsound mind not so found by legal inquisition, the marriage will be invalidated where consent is wanting by reason of the incapacity of either of the parties of comprehending the nature and of fulfilling the physical conditions of the marriage contract.

By the Matrimonial Causes Act, 1937, a marriage may be declared null upon proof that either party to the marriage was at the time of the marriage a mental defective or subject to recurrent fits of insanity or epilepsy.

Weakness of intellect, as distinguished from certifiable insanity or mental deficiency at the date of marriage, is not a sufficient ground for invalidating a marriage. (But see the Matrimonial Causes Act, 1937, Vol. 11).

Under the Matrimonial Causes Act, 1937, in England and Wales, and a corresponding act in Scotland, *supervening insanity* is now a ground for dissolution of marriage. Before the court can dissolve a marriage on this ground. it must be satisfied by medical evidence that the disease is incurable, and that the patient has been continuously under care and treatment for at least five years immediately preceding the presentation of the petition.

In *Reed* v. *Legard* a question arose whether a person of unsound mind was responsible for necessaries supplied to his wife. The articles supplied were for the sole use of the wife, the husband being a person of unsound mind and a patient in a mental hospital. The court held that the fact that a husband was unable to manage his affairs did not absolve him from the obligation, which he contracted when he married, to provide necessaries for the support of his wife. When he married he was of sane mind; and, although he had subsequently become insane, that obligation had not thereby ceased.

Molton v. Camroux was followed in *The Imperial Loan Co. v. Stone*[1] where a promissory note had been signed by a person of unsound mind as surety. The defence was that the person sued was so insane when he signed the note, as to be incapable of understanding what he was doing, and that such insanity was known to the plaintiffs. The case was taken to the Court of Appeal, where it was held that the contracts of a person who is *non compos mentis* may be avoided when there is proof that his condition was known to the other party.

In *York Glass Co. v. Jubb*,[2] the Court of Appeal held that there is no right to avoid a contract made with a person of unsound mind unless it be proved that the other party either knew that he was of unsound mind or knew such facts about him that the other party must be taken to have been aware that he was of unsound mind.

It is significant that the Judicial Committee of the Privy Council upon at least two occasions since the decision in *The Imperial Loan Co. v. Stone* have refused to follow that decision. The two cases referred to are *Daily Telegraph Newspaper Co. v. McLaughlin*[3] and *Molyneux v. Natal Land and Colonisation Co.*[4]

Supervening insanity does not release a person from his obligations under a contract unless the nature of the insanity render the performance of the contract impossible.[5]

The general law of agency is not invalidated by the insanity of one of the parties; and in *Yonge v. Toynbe*[6] the Court of Appeal decided that an agency created during sanity will be determined *ipso facto* by the insanity of the principal or of the agent. So that where an authority given to an agent has, without his knowledge, been determined by the insanity of the principal, and, subsequently to such insanity the agent has, in the belief that he was acting on behalf of the principal, made contract with a third person, the agent will be liable in respect of any damage which may be sustained by the third party by reason of the non-existence of the principal's authority.

The insanity of a partner does not *of itself* dissolve the partnership, unless the articles of partnership contain a provision to that effect; hence, unless steps be taken for dissolution, the insane partner continues to be entitled to share the profits and to be liable for the losses of the firm.

[1] (1892) 1 Q.B.D. 599
[2] (1925) 42 T.L.R. ?
[3] (1904) A.C. 776
[4] (1905) A.C. 555
[5] *Hall v. Warren*, 9 Ves. 605
[6] (1910) 1 K.B. 215
[7] *In re Rhodes* 44 Ch.D. 94 and Sale of Goods Act, 1893.
[8] *Drew v. Nunn*, 4 Q.B.D. 661

An examination of the leading English text-books on the law of torts shows that there is a remarkable absence of authority on the question whether a person of unsound mind is liable for his torts. In this connection Sir William Markby wrote:[1] "How far a person who is insane would be held responsible, in courts of civil procedure, for his acts or omissions independently of contract, is a matter on which one is surprised to find our law books nearly silent".

The most authoritative statement of the law of England upon this matter would appear to be that which was made by Lord Esher in *Hanbury* v. *Hanbury*,[2] where he said that he was "prepared to lay down as the law of England that whenever a person does an act which is either a criminal or a culpable act, which act, if done by a person with a perfect mind, would make him civilly or criminally responsible to the law, that was an act for which he could be civilly or criminally responsible to the law, *provided the disease of the mind of the person doing the act be not so great as to make him unable to understand the nature and consequence of the act which he is doing*".

It is beyond the scope of this work to discuss the matter further; those seeking additional information are referred to "Insanity in Relation to Legal Responsibility", Cook, 1921.

(v) Testamentary Capacity

This is discussed under the following heads: —

A disposing mind—Aphasia and will-making—Delusions and will-making —Eccentricity and will-making—Undue influence and will-making - Suicide and will-making—Wills *in extremis*.

A Disposing Mind. Questions involving the testamentary capacity of persons arise frequently, and medical evidence is usually required. When the testator disposes of his estate in an abnormal manner, it may be alleged by the relatives that he was wholly incompetent to understand the nature of his act—either from insanity, dementia as a result of disease or on the approach of death. The law requires a *disposing mind* in order to render a will valid. The practical test is: Did the testator, at the time of executing the will, know the nature and amount of his property and was he able to recognize the just and reasonable claims of others upon him? It has been said truly that the evidence on this matter of the will is of greater value than the opinions of experts or of witnesses who may have seen the testator at other times and in other circumstances. The capacity for making a will does not depend solely upon the testator's sanity or insanity, but rather upon the proof of competency or incompetency on the part of the testator at the time when he made the will.

property than to anything else; and, so long as the terms of the will do not seem to inflict any substantial injustice upon any near relatives, it is probable that the will will be upheld.

An attempt to deal with the situation created by the moral incapacity of a testator is made by the *Inheritance (Family Provision) Act, 1938*, whereby a surviving spouse or other dependant of a testator or testatrix who dies domiciled in England or Wales, may apply to the Court for an order for reasonable provision to be made for his or her maintenance in cases where the deceased by his will has failed to make reasonable provision for the maintenance of the applicant. Many successful applications have been made under this statute.

Test of Capacity. The question of testamentary capacity is eminently a practical one, and it is one which does not depend solely on scientific or legal definition. In determining whether or not a testator at the time of making his will was possessed of testamentary capacity, the court takes account of the following considerations: there must be on the part of the testator a sound mind, as well as a memory *which is able to recall the several persons who may be fitting objects of his bounty*, and an understanding to comprehend the relationship of the beneficiaries to himself, and their respective claims upon him. By "sound mind" the law does not mean a perfectly balanced mind; because, if this were so, no one would be competent to make a will. The law makes considerable allowance for diversity of character; it disregards eccentricities of manner, of habits of life, of amusements, of dress, and so on. The general test is: Was the testator, *at the time of making the will*, labouring under a delusion material to his judgment and decision with regard to the disposal of his property? It is essential to the exercise of the power of making a will that the testator shall not be suffering from any disorder of the mind, which would poison the affections, pervert his sense of right, or prevent the exercise of his natural faculties; that no insane delusion shall influence his mind in disposing of his property in such a way as would not have been done if the mind had been sound.[1]

As a general rule, the will of a person of unsound mind made during his insanity is void; but the will of a person of unsound mind, whether so found or not, made during a lucid interval is valid. A will executed during insanity does not become valid by the subsequent recovery of the patient.

There is, however, a difference between unsoundness of mind indicated by unfitness to manage one's affairs and that defect of mind which deprives a man of the power of disposing of his property by will. A mind may be clear enough for the performance of some functions, and yet be not clear enough *for the performance of others.* A man may give clear and reasonable directions for the preparation of a will, and even sign it in a natural manner, but he may be governed by caprice and passion amounting to insanity *ad rem.,* i.e., in the disposition of his property. A disposing power may exist in the mind of a person not legally competent to manage his own affairs. The criteria applied are different, and the existence thereof must be proved in each particular case.

Where the validity of a will is contested on the ground of incapacity, the issue is not *whether the testator could have made a will,* but *whether he had capacity to make the particular will in dispute*; and in order to form a proper judgment on this matter, a medical expert intended to be called as a witness should read the instrument before he gives an opinion.

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[1] *Banks v. Goodfellow,* 5 Q.B., 549.

Aphasia and Will-making. The fact that certain structural lesions of brain may affect a patient's powers of communication and comprehension, without otherwise impairing his soundness of mind, may be of particular importance in regard to the making of a will.

Aphasia is one of a series of terms used to describe specific failure of communication or comprehension of this nature; aphasia may be sub-divided into motor aphasia, which means inability to communicate accurately by speech; and sensory or auditory aphasia, standing for a corresponding *inability to comprehend the spoken word. Similarly, agraphia signifies a* comparable failure to communicate by writing, and alexia a failure to comprehend by reading. It is important to realise that each of these types of failure of communication or comprehension may occur separately or in combination with others; but that they all have in common a failure of the powers to recognise or reproduce the normal symbols of communication of human thought, without necessarily implying any impairment of the underlying thought processes themselves. A patient suffering from any form of aphasia, agraphia, alexia, or similar disability, may therefore possess a perfectly sound disposing mind, but be incapable of communicating his *wishes through the normal channels of speech or writing. Equally, although* capable of understanding his obligations to others, he may not be able to comprehend written instructions or spoken advice as to how he should carry them out.

In general these specific disturbances of a patient's powers of communication or comprehension can be correlated with some accuracy with lesions in various parts of his brain. These are of no importance in the present context, except in so far as recognition of the essentially localised basis of this particular form of mental disturbance will prevent the avoidable error of confusing such disability with any form of insanity.

When a will has been written by a testator in his own handwriting (holograph wills), the only points which need be considered are:—

1. Is the document written in such a manner as to be legible and capable of clear construction?

2. Does it express the wishes of the testator without doubt or ambiguity?

3. Was the testator suffering from any material delusion of the kind considered in the preceding section?

The fact that the will has been written legibly and clearly, and appears to be sensible and free from delusion, excludes the possibility of agraphia and renders irrelevant the possibility of aphasia. But where the will is more or less formally written by others and then submitted to the testator to read and to sign, or is read over to him aloud before signature, difficulties in connection with the possibility of aphasia or agraphia are clearly material. In such cases it is necessary to explore carefully ways of getting into communication with the patient which are reliable; and where such ways can be found, the patient's capacity to make use of them in a reasonable manner can be accepted as evidence of a disposing mind.

An example is provided by the case of a man suffering from disease affecting the brain which rendered him unable to write and only able with difficulty to understand what was said. This man was able by gestures to make it clear that he wished to make a will. He could read and could understand what was written. The doctor in attendance had the name of possible legatees written each on a separate card, and the main items of the testator's estate also written, each on a separate card; the patient was then able to

put a name and piece of property together by means of these cards. Probate in the sense of these terms was in fact granted.

Delusions and Will-making. A dispute may arise about the validity of a will executed by a person suffering from delusions. The mere existence of a delusion in the mind of a person does not of itself necessarily vitiate a will, unless conclusive evidence be given that, at the time of executing the will, the testator's mind was influenced by the delusion in making the will.[1]

Although a will may be manifestly unjust to the surviving relatives of a testator, and it may indicate that the testator held extraordinary views, it will not necessarily be void unless the testamentary dispositions clearly indicate that the testator's mind was affected by his *delusions*.

Delusions may co-exist with testamentary capacity: so that, if the testator comprehends the extent of the property to be disposed of, and the nature of the claims of those whom he excludes, partial insanity, not affecting the general faculties nor operating in regard to testamentary disposition, is insufficient to render him incapable of making a will.[2]

Eccentricity and Will-making. Whereas the will of an eccentric man would probably be such a will as might have been expected from him, the will of a person who is suffering from delusions is different from that which could have been expected had he not been deluded. While it is admittedly difficult to define precisely the distinction between eccentricity and insanity, or to draw the exact line between sanity and insanity, it is normally possible to determine in a particular instance whether a man is sane or insane or only eccentric.

Mere eccentricity must be distinguished from insanity. In *Frere v. Peacock*[3] it was held that moral insanity, or a moral perversion of the feelings, unaccompanied by delusions, is insufficient to invalidate a will.

Sane childless women who live solitary or secluded lives are often very fond of animals. One old lady used to keep her sitting-room full of monkeys, to the great annoyance of her visitors. She was a woman of good family, and of a shrewd and strong mind, well able to look after her affairs and to dispose of her property. She was considered to be eccentric, but there was no indication of insanity. Other women are only happy when surrounded by parrots, or when their sitting-rooms are converted into aviaries for all kinds of birds. In one case, a woman whose sanity was disputed, was very fond of cats, for which she provided meals at regular hours, complete with plates and napkins. In that case insanity was established, not so much on the ground of the special attention which she had given to the cats, as from her acts in regard to her property, and from the history of her association with certain persons who took advantage of her mental weakness. Such fondness of animals does not prove the existence of insanity unless there is at the same time evidence of mental aberration.

In *Boughton v. Knight*,[4] the will was contested by the sons of the testator on the ground of mental incapacity. The testator was a reserved man and shunned society. He had lived alone for some years; and was peculiar and eccentric in his habits. He was fond of listening to German bands, and of seeing his servants dance; he fed rats and shot rooks in company with a female servant. He was of a capricious and suspicious disposition; he had

¹ *Banks v. Goodfellow*, L.R. 5, Q.B. 549.
² *Pilkington v. Gray* (1899) A.C. 401.
³ 1 Rob. 442.
⁴ 3 P. & M. 64.

a delusion that he had perpetrated crimes, and that people were watching him. On the other hand, he had managed his own affairs without any suggestion that he was insane, and his correspondence showed that he was rational and had complete capacity for conducting business.

Although the testator had capacity to manage his property, it was held that he had not sufficient capacity to dispose of it by will. The court held that a man moved by capricious, frivolous, mean, or even bad motives, may disinherit his children, and leave his property to strangers: he may take an unduly harsh view of the character and conduct of his children; but the law places a limit to the extent to which such action may fairly be regarded as a matter merely of harsh, unreasonable judgment, and beyond which revulsion exhibited by a parent towards his own child will be concluded to proceed from some defect or unsoundness of mind.

From the judgment delivered in *Smith* v. *Tebbitt*[1] it appears that the question of insanity is a mixed one, partly within the range of common observation and partly within the range of special experience; and it is the duty of the court to inform itself of the general results of medical observation. A medical expert may give an opinion as to whether the acts of an eccentric testator are evidence of delusions. He may also be able to say, from a consideration of the previous habits and manner of life of the testator, whether at or before the making of the will there has been any change of habits or character which would indicate insanity—*e.g.*, the existence of an unaccountable hatred of members of the family who are not mentioned in the will, and a suspicion and distrust of all around him. Cruelty to children, unnatural conduct towards a wife, and the keeping and feeding of animals as pets, are matters which can be considered in relation to testamentary capacity as well by a learned judge as by experts in insanity.

Undue Influence in Will-making. "Undue influence" is frequently alleged as a ground for having a will set aside. The exercise of undue influence by one person over a testator, in order to procure a will in favour of himself or of some third person, renders the will invalid. What amounts to undue influence depends upon the circumstances of each particular case.

In order to set aside a will on this ground, it must be shown that the circumstances in which the will was executed are inconsistent with any hypothesis other than of undue influence. The exercise of undue influence must be proved to have been exercised in relation to the will itself, and not merely to other transactions.[2]

"Undue influence" is possible as a rule only when the testator is below the average mentally; for example, when he is suffering from incipient dementia, such as often accompanies old age. In such cases, however, it frequently happens that someone (daughter, second wife, niece, or stranger) takes special care in looking after the testator, and when the devoted nurse benefits under the will, disappointed relatives sometimes raise the question of undue influence. In these cases, if a medical man is present when a will is executed, he may easily satisfy himself as to the state of mind of a testator, by requiring him to state from memory the manner in which he has disposed of the bulk of his property.

A person may resort to honest intercession and persuasion quite properly in order to procure a will in favour of himself; but persuasion brought to bear

[1] L. R. & D. 398.
[2] *Boyse* v. *Rossborough*, 6 H.L.C. 2.

upon a testator who is on his deathbed, or in a weak state of health, may be equivalent to force inspiring fear, *e.g.*, if such persuasion amounts to importunity which the testator is too weak to resist, and which renders the making of the will no longer the offspring of his own volition.[1]

If a medical man be disinterested, he may be of great service in the case of a disputed will; but when a medical man takes a direct benefit under the will, the court will inquire very closely into all the circumstances connected with the drawing up and execution of the will. The court may set aside such a will on the ground of undue influence, inasmuch as the position of a medical attendant is very similar to that of a trusted friend, nurse or adviser.

If a medical man expects to benefit under the will of a patient with whom he is on familiar terms, he should take the greatest care to secure the intervention of a professional lawyer, with a view to placing his own position above suspicion.

If a beneficiary under a will, or his or her spouse, signs his or her name as a witness to the will, the gift to such beneficiary will be void.[2]

Suicide and Will-making. The act of suicide is sometimes assumed to be evidence of insanity; but it is not accepted as conclusive proof of insanity even where the testator took his life shortly after the execution of his will. A testator committed suicide three days after having given instructions for his will; but, in the absence of other evidence of insanity, the will was pronounced valid. In *Edwards* v. *Edwards*, the testator committed suicide three days after the execution of his will, and there was some evidence of eccentric habits almost amounting to insanity; the will was pronounced to be valid. Suicide *per se* is not deemed in law to be a proof of insanity (*vide* "Suicide").

Wills in Extremis. Where a person whose mental capacity during life has never been doubted makes a will while lying at the point of death (*in extremis*), such will may be regarded with suspicion; and may be set aside if there is medical evidence that the testator had not a disposing mind at the time of the execution of the will. Many diseases, particularly those which affect the brain or nervous system directly or indirectly, produce a dullness or confusion of intellect which may deprive the patient of his testamentary capacity.

A will was set aside because it was executed by the testatrix while she was suffering from an attack of cholera, and proper means had not been taken to test her capacity. At the time of the execution of the will, the testatrix was reduced to such an extreme state of weakness that her mental powers were impaired. The validity of another will was contested on the ground that the testator was at the time of execution suffering from gastritis. The will was witnessed by the medical attendant and by the solicitor, both of whom deposed to the competency of the testator, *i.e.*, that the disease had not reached that point where the brain was affected or the mind disturbed. In all cases of this nature *integritas mentis non corporis sanitas exigenda est.*

A will executed by a dying person during delirium would be pronounced invalid. On the other hand, on some occasions, when the mind has been weakened by disease or infirmity from age, it has suddenly become clear before death; and the person has unexpectedly shown a disposing capacity.

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[1] *Wingrove* v. *Wingrove*, 11 P.D. 81.
[2] Wills Act, 1837, s. 15.

Where a testator made his will when on his deathbed, his medical attendant took his instructions, and shortly afterwards a solicitor drew the will in accordance therewith. The medical attendant and the solicitor attested the will, but it was alleged that, although he was conscious when instructions were given, the testator was unconscious when the will was executed. The solicitor thought that he was quite unconscious at the time of execution. The physician and the nurse thought that he was conscious.

The law requires not only that a man should be conscious at the time of execution of the will, but that he should have a sound and disposing mind. The party propounding the will is bound to establish this; and, where he fails to do so, the will must be declared invalid. It would appear from the evidence in the above case that the will was signed *within ten minutes* of the time at which the testator was known to have lost consciousness. His property was bequeathed to a stranger. At the time of executing the will the deceased said nothing, did nothing, and made no movement to indicate that he was aware of what he was doing.

A relative of the husband of a dying woman (who was aged 76) took instructions from her for her will which was drawn in his favour. The medical man gave evidence that the deceased had died from apoplexy, and that at the time of executing the will she was so exhausted by illness and by the near approach of death as to be incompetent. On the day of the execution of the will, the deceased retained in some measure her consciousness; it was very doubtful whether she had sufficient capacity to make a will. No other person was present when the instructions were given, and the husband's relative did not even take the precaution of reading the will over in the presence of the witnesses. Even if the deceased had full possession of her faculties at the time, there was some doubt whether she was fully aware of the contents of the will when she signed it. The relative of the husband *failed to satisfy the court that the deceased knew and approved* the contents of the will, and the court therefore pronounced against it.

Whenever possible, care should be taken to make certain that the testator is able to state the provisions of the will, and to repeat them substantially from memory.

If the testator, at the time of giving instructions to a solicitor to prepare his will, is competent to make a will, the will will be valid although *at the time of execution* he may be too ill to understand the contents thereof, provided that he is conscious of having given the instructions and believes that the will has been prepared in accordance with them.[1]

was acquitted on grounds of insanity on the judges' direction. At that time Broadmoor did not exist, and, although by an Act of 1800 criminal lunatics had a special legal status, arrangements for their security and care were not impressive. The public reaction to their acquittal was most unfavourable and eventually led to a debate in the House of Lords, where five questions were put to those of its members who were judges. The questions and answers are as follows:—

Question 1.—"What is the law respecting alleged crimes committed by persons afflicted with insane delusions in respect of one or more particular subjects or persons, as, for instance, where, at the time of the commission of the alleged crime, the accused knew he was acting contrary to law, but did the act complained of, with a view, under the influence of insane delusion, of redressing or revenging some supposed grievance or injury, or of producing some supposed public benefit?"

Answer 1.—"Assuming that your lordships' inquiries are confined to those persons who labour under such partial delusions only, and are not in other respects insane, we are of opinion that (notwithstanding the accused did the act complained of with a view, under the influence of insane delusion, of redressing or revenging some supposed grievance or injury, or of producing some public benefit), he is nevertheless punishable according to the nature of the crime committed, if he knew at the time of committing such crime that he was acting contrary to law, by which expression we understand your lordships to mean the law of the land."

Question 2.—"What are the proper questions to be submitted to the jury when a person, alleged to be afflicted with insane delusions respecting one or more particular subjects or persons, is charged with the commission of a crime (murder, for example) and insanity is set up as a defence?"

Question 3.—"In what terms ought the question to be left to the jury as to the prisoner's state of mind at the time when the act was committed?"

Answers 2 and 3.—As these two questions appear to us to be more conveniently answered together, we submit our opinion to be that the jury ought to be told in all cases that every man is presumed to be sane, and to possess a sufficient degree of reason to be responsible for his crimes, until the contrary be proved to their satisfaction; that to establish a defence on the ground of insanity, it must be clearly proved that, at the time of committing the act, the accused was labouring under such a defect of reason, from disease of the mind, as not to know the nature and quality of the act he was doing, or, if he did know it, that he did not know that he was doing what was wrong. The mode of putting the latter part of the question to the jury on these occasions has generally been, whether the accused at the time of doing the act knew the *difference between* right and wrong; which mode, though rarely, if ever, leading to any mistake with the jury, is not, we conceive, so accurate when put generally and in the abstract, as when put with reference to the party's knowledge of right and wrong in respect to the very act with which he is charged. If the question were to be put as to the knowledge of the accused, solely and exclusively with reference to the law of the land, it might tend to confound the jury by inducing them to believe that an actual knowledge of the law was essential in order to lead to a conviction; whereas the law is administered on the principle that everyone must be taken conclusively to know it without proof that he does know it. If the accused was conscious that the act was one which he ought not to do, and if that act was at the same time contrary to the law of the land, he is punishable. The usual course, therefore,

has been to leave the question to the jury, whether the accused had a sufficient degree of reason to know that he was doing an act that was wrong; and this course we think is correct, accompanied with such observations and corrections as the circumstances of each particular case may require."

Question 4.—"If a person under an insane delusion as to existing facts commits an offence in consequence thereof, is he thereby excused?"

Answer 4.—"The answer must of course depend upon the nature of the delusion; but, making the same assumption as we did before, namely, that he labours under such partial delusion only, and is not in other respects insane, we think he must be considered in the same situation as to responsibility as if the facts with respect to which the delusions exist were real. For example, if, under the influence of his delusion, he supposes another man to be in the act of attempting to take away his life, and he kills that man, as he supposes, in self-defence, he would be exempt from punishment. If his delusion was that the deceased had inflicted a serious injury to his character and fortune, and he killed him in revenge for such supposed injury, he would be liable to punishment."

Question 5.—"Can a medical man, conversant with the disease of insanity, who never saw the prisoner previously to the trial, but who was present during the whole trial and the examination of the witnesses, be asked his opinion as to the state of the prisoner's mind at the time of the commission of the alleged crime, or his opinion whether the prisoner was *conscious* at the time of doing the act that he was acting contrary to law, or whether he was labouring under any, and what, delusions at the time?"

Answer 5.—"We think that the medical man, in the circumstances supposed cannot in strictness be asked his opinion in the terms above stated, because *each of those questions involves the determination of the truth of the facts deposed to*, which it is for the jury to decide, and the questions are not mere questions upon a matter of science, in which case such evidence is admissible. But where the facts are admitted, or not disputed, and the question becomes substantially one of science only, it may be convenient to allow the question to be put in the general form, although the same cannot be insisted on as a matter of right."

The McNaghten Rules

These answers have come to be known as the *McNaghten Rules*, and they are in essence as follows: in order to establish a defence on the grounds of insanity, it must be clearly proved that at the time of committing the act the accused was labouring under such defect of reason from disease of mind as not *to know* the nature and quality of the act he was doing; or if he did know what he was doing, that he did not know that it was wrong. The second important provision is that if the accused commits the act by reason of a delusion, the degree of responsibility which must be attached to him, and therefore in law the degree of culpability which must be attributed, is based upon the justification which the delusion would provide if it were true.

This latter provision means, to take an example from two contemporary cases, that if a man suffering from delusions believes that another man is killing him by electronic thought waves, and kills this other man in self-defence, he cannot be punished; although of course, and very properly, he will be sent to a criminal mental hospital. But if on the other hand his delusions were limited to a conviction that his victim had been depriving him of his good name and sexual power by magical means, then, since even if this were true, it

would not justify homicide in self-defence, it cannot be accepted as a legitimate defence against a charge of murder, which is at present punishable by death. More than eighty years ago Stephen recognized the frank absurdity of evaluating insane delusions as if they were true, in assessing the sufferer's responsibility. He pointed out that the evidential significance of a delusion is that it is "in all cases the result of a disease of the brain, which interferes more or less with every function of the mind, which falsifies all the emotions, alters in an unaccountable way the natural weight of motives of conduct, weakens the will . . . ."

But Stephen's attempt to interpret the rules in a way which would bring them into conformity with clinical facts was opposed by his colleagues, and particularly by Lord Bramwell, who in 1874 is quoted as having said, trenchantly but with an unusual disregard for syntax, "I think that, although the present law lays down such a definition of madness, that nobody is hardly ever really mad enough to be within it, yet it is logical and a good definition."

Medical men would agree only with the first part of Lord Bramwell's pronouncement. Justification for this limited measure of agreement is provided by an illustration of the sort of mental state envisaged by the McNaghten Rules. Professor Kenny, in his text-book "Outlines of Criminal Law", 15th edition, page 60, gives this representative example: "The madman cut a woman's throat under the idea he was cutting a loaf of bread . . . ." A further example is provided by the words of Mr. Justice Cassel, in the trial of Straffen[1]. Straffen was a feeble-minded youth, who, on the occasion of a previous murder, had been found unfit to plead because of mental deficiency. Some years later he escaped from Broadmoor, where he had been confined, and in a few hours of liberty committed another murder. Explaining to the jury the meaning of the phrase in the Rules about not knowing "the nature and quality of the act", the judge said: "If a person was charged with having manually strangled some person and the jury were satisfied that when he strangled that person he thought he was squeezing the juice out of an orange, that would be a failure to know the nature and quality of his act."

These dicta suggest that under the McNaghten Rules, not knowing the nature and the quality of the act means that the accused person must be grossly mistaken about its physical nature. Any doctor with experience of mental illness knows that madness of this particular kind is a legal fiction. Lord Coleridge, Lord Chief Justice of England in 1888, observed that "The judicial decisions on questions of insanity were bound and tied by an old authority which, by the light of modern science, was altogether unsound and wrong." By these standards, both in their relationship to the accused person's knowledge of what he was doing, and the degree to which the effect of delusions upon his actions be taken into account, correct interpretation of the Rules would necessarily have to be so strict that not only would "nobody be hardly ever really mad enough" to be covered by them, but, what is probably more important, once juries realized this they would also grasp that the great majority of patients certified insane, and permanent inmates of mental hospitals, would have to be regarded as responsible in law for any crime that they committed.

In the notorious case of *R. v. True*,[2] the prisoner was convicted of the murder by strangulation in brutal circumstances of a young prostitute, whom he had robbed of her jewellery. The plea of insanity was put forward by the defence on the grounds that the accused was overwhelmed by an impulse which,

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[1] The Trial of John Thomas Straffen. "Notable British Trials" Series: Vol. 80 (1954).
[2] (1922), 16 Cr. App. Cas. 165.

by reason of disease of the mind, he was unable to resist. This type of plea, sometimes called one of "irresistible impulse", is not recognized by the McNaghten Rules. At True's trial the Lord Chief Justice said: "In the view of this court there is no foundation for the suggestion that the rule derived from *McNaghten's* case has been in any sense relaxed." The Court of Criminal Appeal held that the jury were entitled to say that the facts of the case, taken as a whole, satisfied them that at the time of committing the act the prisoner was not insane. The appeal having been dismissed, the sentence of death stood; but the prisoner was reprieved by the Crown and ordered to be detained during His Majesty's pleasure.

It is unquestionably possible in theory for an insane person to be held criminally responsible in England. In Scotland the position is somewhat different, for as long ago as 1863 it was laid down that "in a strictly legal sense, there is no insane criminal. Concede insanity, and the homicidal act is not criminal. The act of the insane, which in the sane would be criminal, lacks every element of crime." (Lord Justice Clerk Inglis). Consequently, there is no such verdict under Scots Law as "guilty but insane." Furthermore, in Scotland, at least in cases of serious crime, a defence of "diminished responsibility" is admissible, where it can be clearly shown that there exists "an aberration or weakness of mind," or "a state of mind bordering on, though not amounting to, insanity"—states which are met with, for example, in certain cases of epilepsy, or following head injuries. The effect of a successful plea of diminished responsibility is to reduce the quality of an act from murder to culpable homicide (i.e. the Scots equivalent of manslaughter). In England, no such doctrine has been formally accepted, although the Infanticide Act recognizes just such a degree of diminished responsibility in the case of a mother who kills her child in certain circumstances (see "Infanticide")—and the effect of this recognition is similarly to reduce the quality of her act from murder to manslaughter.

The Lord Chancellor's Committee. As a sequel to *True's* case, the Lord Chancellor on July 10th, 1922, appointed a committee "to consider what changes, if any, are desirable in the existing law, practice and procedure relating to criminal trials in which the plea of insanity as a defence is raised, and whether any and, if so, what changes should be made in the existing law and practice in respect of cases falling within the provisions of sect. 2. (4) of the Criminal Lunatics Act, 1884."

The committee reported that the British Medical Association desired to retain the existing law with a modification as to lack of control; but the Royal Medico-Psychological Association (whose views the committee could not accept) desired to "sweep away the present rules", and to substitute other specified questions for the jury. The Royal Medico-Psychological Association recommended: —

(1) That the legal criteria of responsibility expressed in the rules in *McNaghten's* case should be abrogated, and the responsibility of a person should be left as a question of fact to be determined by the jury on the merits of the particular case;

(2) That in every trial in which the prisoner's mental condition is in issue the judges should direct the jury to answer the following questions:

   (a) Did the prisoner commit the act alleged?

   (b) If he did, was he at the time insane?

   (c) If he was insane, has it nevertheless been proved to the satisfaction of the jury that his crime was unrelated to his mental disorder?

The recommendations of the Lord Chancellor's committee (November 1st, 1923) were as follows:—

"1. It should be recognized that a person charged criminally with an offence is irresponsible for the act when the act is committed under an impulse which the prisoner is by mental disease in substance deprived of any power to resist.

"2. Save as above, the rules in *McNaghten's* case should be maintained.

"3. Where a person is found to be irresponsible on the ground of insanity, the verdict should be that the accused did the act (or made the omission) charged, but is not guilty on the ground that he was insane so as not to be responsible, according to law, at the time. The existing statutory provision in this respect should be amended.

, "4. Under such amendment the verdict should always be taken and entered as guilty of the act charged, but insane so as not to be responsible, according to law, for his actions at the time.

"5. Accused persons should not be found on arraignment unfit to plead except on the evidence of at least two doctors, save in very clear cases.

"6. The present law as to appeal should not be altered; *i.e.*, there should be no appeal on the finding of insanity either on arraignment of after trial. and in the latter case either as to the act or omission charged or as to insanity.

"7 Provision should be made, under departmental regulations, for examination of an accused person by an expert medical adviser at the request of the prosecution, the defence, or the committing magistrate.

"8. Provision for a panel or panels of mental experts is unnecessary."

As to the Criminal Lunatics Act, 1884:—

"9. It is essential that the statutory power under sect. 2 (4) should be maintained.

"10 The procedure under the sub-section is satisfactory and does not require amendment.

"11. The discretion of the Secretary of State should be exercised as at present."

The committe reported that the Royal Medico-Psychological Association gave no clue to what they regarded as the test of criminal responsibility.

The committee's recommendation that a modified recognition should be given to the doctrine of irresistible impulse was referred to twelve High Court judges, who were consulted in 1924 as to the propriety of legislation for giving effect to such recommendation. Ten out of the twelve judges advised against the proposed alteration of the criminal law. A bill (The Criminal Responsibility (Trials) Bill) embodying the recommendation of the committee was introduced into Parliament, but was afterwards withdrawn.[1]

In fact, the concept of irresistible impulse is not one which doctors would regard as an improvement or a desirable modification of the McNaghten Rules. It raises more problems than it solves, and it is not a defence as the law stands to-day.[2]

In the case of *R.* v. *Allnut* the judge, commenting on evidence as to alleged uncontrollable impulse, asked what was the meaning of not being able to resist an impulse. Every crime was committed under an impulse, and the object of the law was to compel persons to control or resist these impulses.

If it was made an excuse for a person who had committed a crime that he had been goaded to it by some impulse which medical men might choose to say he could not control, such a doctrine would be fraught with very great danger to society. Stephen, whose observations on this as on most legal subjects are of great force and interest, in his History of the Criminal Law of England, Volume 11, Chapter 17, wrote:—

> "Knowledge and power are the constituent elements of all voluntary actions, and if either is seriously impaired the other is disabled. It is as true that a man who cannot control himself does not know the nature of his acts as that a man who does not know the nature of his acts is incapable of self-control."

Stephen appeared to think that the conditions laid down by the judges in 1843 after *McNaghten's* case were wide enough to include as a defence irresistible or uncontrollable impulse. But, as stated above, the courts have decided otherwise.

Difference between Law and Medicine

There is a distinction between lawyers and medical men in the meanings which they attach to the words "right" and "wrong"; to the lawyer they mean lawful or unlawful, that is, permitted or forbidden under certain penalties, by the law of the land at the time.

It has always been a principle of the McNaghten Rules that the accused's knowledge of right and wrong should be put to the jury with reference to the act charged rather than generally. "If the accused was conscious that the act was one that he ought not to do, and if that act was at the same time contrary to the law of the land, he is punishable."

There would seem to have been an increased rigidity introduced into this interpretation by subsequent decisions. The judges who formulated the Rules appeared to recognize the distinction between subjective right and wrong in the mind of the accused person, and objective right and wrong as defined by the law of the land, and to have held the former to be the criterion. From a psychological point of view this makes sense. A man who believed that another was the incarnation of Satan, and that he was commanded by God to kill this person, would have been excused by the original formulation of the Rules; although it is important to realize that this is no longer true in the light of subsequent interpretations of the Rules as they are administered to-day. A later decision in the Appeal Court has laid it down that if a man knows his act is against the law it is enough.[1] The same point is made by Professor Kenny in his book "Outlines of Criminal Law" to which reference has already been made.

The principal medical criticisms levelled against the Rules are founded upon two points; the first that the Rules make no provision for the effect upon conduct of pathological disturbances of emotion, as opposed to disturbance of reason or knowledge; and the second that, as the diagnosis of any kind of insanity is a complex medical task, it cannot reasonably be entrusted to a panel of laymen, the jury.

To illustrate the first objection we may take the case of a man suffering from acute depression, one of the most common forms of serious mental illness. Such a man may be driven by his illness to attempt to commit suicide: but if he has a dependent relative, for example an aged mother, he may kill her first in his mood of utter despair, and subsequently be apprehended

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[1] *R. v. Windell*, 1952, *J.A.E.R.*, page 1.

before he can take his own life. In such a case it is clearly difficult for the honest expert medical witness to maintain that the man did not know what he was doing or that it was wrong. But the balance of his mind is no less over-thrown, and his sanity is no less impaired, because the disturbance is primarily emotional rather than rational.

Considerations of this kind have been thought to lend some weight to the second objection, and this has in fact prevailed in certain States of America which were formerly bound by the McNaghten Rules. A Statute passed in Colorado in 1927 provides that every person pleading insanity, or any form of mental aberration in defence or extenuation, shall be submitted for thirty days to the State Hospital, whence a report is prepared for the court. This may subsequently be questioned by Counsel for either side, but rarely is. The procedure is conceived as a means of ending that unedifying spectacle, the battle of the experts, whereby psychiatrists engaged on behalf of the Crown and of the defence may contradict each other's interpretations and confuse the jury.

However, not all medical objections to the McNaghten Rules are themselves free from confusion. Doctors have to remember that the law does not presume to define insanity. That is accepted as a medical question. What the law considers are the conditions which have to be satisfied in order that a person may be excused from criminal responsibility.[1]

The same point is made by Kenny in his text-book: "The courts are concerned not with insanity as such, but with criminal responsibility."

Moreover, the determination of such responsibility, like that of every other question of fact or opinion in the course of trial by jury, must be finally made by the jury themselves. The McNaghten Rules were laid down with remarkable clarity and precision for the guidance of judges in directing juries *as to the law with regard to criminal responsibility* in a particular set of circumstances. They do not pretend to define insanity from a medical point of view. A measure of public support for them is based upon salutarily jealous concern for the ultimate powers of the jury, reinforced by their apparent logic and common sense. But medical men are bound to point out that this appearance is deceptive, since the Rules are derived from an over-simplified and now obsolete concept of human mental processes.

But this discontent of medical men with the McNaghten Rules has never been generally shared by men of law. The Lord Chancellor's Committee, which was essentially a legal committee, said in their report of November 1st, 1923, " . . . much of the criticism directed from the medical side was based upon a misapprehension. . . . When once it is appreciated that the question is a legal question, and that the present law is that a person of unsound mind may be criminally responsible, the criticisms based upon a supposed clash between legal and medical conceptions of insanity disappears."

In *R.* v. *Pank*[2] the insane prisoner was under the double delusion (i) that his sister-in-law wished to commit adultery, and (ii) that it was consequently his duty to kill her in retribution. The judge directed the jury thus: "He knew the nature and quality of his act, for he knew that he was shooting, and that this shooting would kill her. Did he know that it was 'wrong'? If he knew that his act would be wrong in ordinary circumstances, it is no defence that he thought that the special circumstances present in this particular case would render it justifiable in him to do that act." He was convicted and executed.

[1] *Essays and Observations, Criminal Law and Insanity*, Lord Hewart, 1929.
[2] *Brit. med. J.* 1934. I, 1031.

Schizophrenia. In *R. v. Phillips*,[1] a theological student, aged 21, murdered and mutilated a manservant at his college. Upon medical evidence that he was suffering from schizophrenia, he was found guilty but insane. There have been a number of murder cases in recent years where juries have returned verdicts of guilty but insane upon evidence that the accused was suffering from schizophrenia at the time of committing the act.

Sadism. The Court of Criminal Appeal has held that sadism is not a form of insanity so as to justify a verdict of "guilty but insane."[2]

Matters which are of assistance in deciding as to Sanity or Insanity of a Criminal

An erroneous notion prevails that a "homicidal lunatic" is easily to be distinguished from a sane criminal by some *certain and invariable symptoms or features*. But a perusal of the evidence given at a few trials will show that each case must stand by itself. It may be said that in one case the murderous act was committed from a motive – *e.g.* of revenge; in a second from no motive, but from irresistible impulse; in a third from illusion or delusive motive – *i.e.*, mental delusion; in a fourth from perverted moral feeling without any sign of mental aberration. This classification probably comprises all the varieties of homicidal insanity, but it does not assist in ascertaining in a doubtful case, whether the act was or was not committed by a person suffering from any of these psychological conditions.

There are three sources from which evidence of the insanity of an accused person may be obtained, viz.:—

1. The family history.
2. The personal history at the time of and prior to the offence.
3. The surroundings of the offence itself.

Family History. The importance of family history in the assessment of the possibility of insanity in a particular individual is something which can only be accurately decided by a fully trained psychiatrist with adequate experience. The pitfalls in attaching importance to insanity, epilepsy, abnormality of brain function, or mental defect in members of the family, are numerous; for example the over-all studies of Professor Kohler suggest that the difference between the percentages of family involvement in mental illness, between the relatives of sane and insane persons, is only about 15 per cent. About 76 per cent of the families of insane persons reveal a history of mental illness or defect, while no fewer than 60 per cent of the families of sane persons reveal a similar incidence. The implication contained in the latter figure, that at least two-thirds of the normal population have a family history including some major nervous or mental illness, is certainly not exaggerated.

In some trials there has been a tendency to rely upon hereditary predisposition as almost the sole proof of insanity in an accused person. In *R. v. Christiana Edmunds*, where the prisoner was convicted of poisoning on an extensive scale, no evidence of insanity or of homicidal impulse could be found. There was a motive, an endeavour to fix the crime upon others, great skill in its perpetration, concealment with a full knowledge of the consequences of the act and of the punishment attached to it, and an endeavour to avoid this punishment by a false plea of pregnancy. In short, the conduct of the woman throughout was that of a sane criminal. The jury found her guilty;

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[1] *Brit. med. J.*, 1938, 1, 1031.
[2] *R. v. Hill*, 88, Sol. J., 134.

but in consequence of proof that many members of her family had suffered from insanity in some form, it was thought that there might be some latent degree of insanity in her case, not discoverable by the ordinary methods of examination. This resulted in the commutation of her sentence.

It would be dangerous to treat an accused person as insane merely because some of his relatives have shown instability of mind. Unless such instability is found in the accused, no importance can be attached to the family history.

The extent to which a family disposition to insanity persists throughout succeeding generations is very remarkable; but the truth is difficult of ascertainment unless the information can be obtained from someone who is well acquainted with the family. There is no matter upon which persons in every station of life are more desirous of concealment; and relatives are always ready to deny the existence of a family taint.

Personal History. The alleged criminal may be a sufferer from congenital mental disease; or he may have been previously certified as a person of unsound mind; or he may not have been so certified.

The idea underlying the phrase "lucid interval" is recognized by both law and medicine, for persons of unsound mind occasionally recover for a longer or shorter period to such an extent that they are fully conscious of their actions. Should a crime be committed during this lucid interval the question of responsibility is one of great difficulty. Lawyers contend that during such "lucid interval," a person should be held responsible for his acts; many psychiatrists, however, contend that the perpetration of the criminal act may be due to the reappearance of the insanity, and that therefore there can be no responsibility. It is obvious that no rule can apply to all cases and every one must be subject to careful scrutiny.

Recovery is *always a comparative* matter, and a person who has once been under treatment in a mental hospital, should not be allowed to return to the same circumstances of strain which caused the original breakdown. The following cases are illustrative and point the need for caution:—

A woman was charged with the murder of her daughter, aged six. The child refused to go to school, and later the school attendance officer called at the child's home. The mother seemed worried, and soon afterwards neighbours heard shuffling sounds upstairs in the cottage, followed by an agonized cry. A couple of hours later, a neighbour saw the mother in her garden covered with blood. She said, "I have hit my little girl. Go upstairs and see if I have hurt her." The child was found on the bedroom floor with her head battered in, and a coal hammer lying beside her. When charged with the murder, the mother said that she knew nothing about it. She had been in a mental hospital, and medical evidence was given to the effect that at the time of the crime she was not responsible for her actions. She was found guilty, but insane.

A woman who had been discharged as cured from a mental hospital was out for a walk with her son, when he suddenly missed her. She was found later in the evening, when she stated that she had thrown a boy into the canal. The next morning the parents of a little boy, aged six, notified the police of his disappearance. Connecting the circumstances with the woman's statements, the police commenced dragging operations, and the body of the missing boy was recovered from the canal. When arrested and charged with causing the death of the boy by drowning him in the canal, the woman made no reply.

When a person who has never been certified as insane is charged with a crime, the whole of his past life should be investigated in order to ascertain whether he has ever shown signs of mental instability. Occasionally it may become apparent that while he has been at times mentally abnormal, his conduct has not been sufficiently disturbed or disturbing to justify committal

to a mental hospital; again, the whole environment of his early life, educationally and morally, may have been such as to lead to an obliteration of the dividing line between vice, crime, and insanity. More frequently, however, attempts will be made to show that one of the known causes of insanity has been operative, and that after its operation the person was said to have acted queerly, to have been subject to fits of passion or to delusions, in other words, to have exhibited such a change in his normal conduct as to suggest at least temporary insanity. It is impossible to enter fully into all these causes and the way in which they act, but we may glance briefly at a few of them.

Accident to the head, violent shocks, sunstroke, starvation, fevers and excessive worry are often stated to be predisposing factors.

The puerperium, pregnancy, lactation, and other affections of the female generative organs are known occasionally to produce a mental condition in which a mother may not be responsible for her acts; puerperal mania is frequently associated with homicidal violence inflicted on a child. The killing of the child is usually either the result of a sudden fit of delirium or a sudden impulse, with a full knowledge of the wickedness and illegality of the act. The legal test of responsibility can be applied to such cases only on the assumption that insanity already exists. Women have been known to ask that the child may be removed, but afterwards seized an opportunity for killing it. Such cases are distinguished from deliberate child-murder by the fact that there is no motive, no attempt at concealment, and no denial of the crime. In this connexion the merciful provisions of the Infanticide Act should be borne in mind.

Where there is a history of epileptic fits relating to an accused person, a defence of irresponsibility is often raised. Although the effects of infantile epilepsy may often be exaggerated by the defence, there is no doubt that continued epilepsy is apt to be associated with dementia, and that during progress of the disease, destructive impulses may be produced. In *R. v. Perry*,[1] it was decided that, in order to sustain the defence of insanity, epilepsy must be proved to have existed at the time of the commission of the crime. The Lord Chief Justice of England said that it must be shown that the man was suffering from an epileptic seizure at the time when he committed the murder. The medical witnesses were unable to indicate any test by which the court could distinguish between the acts of a sane man and those of an insane man.

Where there is a previous history of delusions, or of moods of depression amounting to despair, the opinion of the medical men may well differ from that of the lawyers connected with the case. We have already seen the way in which medical and legal views as to the significance of delusions in themselves may differ. The existence of a delusion, if it can definitely be proved to be genuine, will be accepted by medical men at once as an indication of insanity; but the lawyer demands further evidence that:

1. The delusion was connected with the offence and with the person against whom the offence was committed;
2. That the delusion was so dominant in the mind of the accused as to cloud for him the distinction between right and wrong.
3. That it led to an impulse which was beyond his control to suppress.

And even then, the McNaghten Rules remain capable of rigid interpretation in respect of delusions. Even more rigid may be their effect upon the admis-

[1] (1919) 14 Cr. App. R. 48.

sibility of evidence relating to disorder of mood. We have already seen that a seriously depressed patient, with a history of previous episodes of depression and despair, may murder a close relative as a preliminary to suicide. Such a depressed patient will often maintain strenuously that he knew both the nature and quality of his acts, and that they were wrong; he may add that his guilt is overwhelming, and that he deserves and expects to die. Such protestations, considered together with the history of previous episodes of depressive illness, point very powerfully to insanity. But because the balance of the patient's mind is disturbed along emotional rather than rational lines, all too often no psychiatric defence is legally possible, at least if the McNaghten Rules are strictly interpreted in such a case.

The Surroundings of the Offence itself.

There are exceptions to almost every one of the following factors, but in combination they afford weighty evidence of insanity.

Absence of Accomplices. The lack of ability to act with others is, perhaps, the most striking feature of insanity; when a person of unsound mind commits a crime, he does not usually confide in any one. There are of course exceptions to this general observation. In the case of *R. v. Ley and Smith*[1] (the notorious "chalk-pit murder case"), Ley, a former Australian politician, in late middle-age developed insane delusions which led him to conspire with others, whom he paid, to kidnap and subsequently murder a hotel barman, whose body was later discovered in a chalk-pit. While refusing to allow his Counsel to raise a plea of insanity on his behalf, and insisting upon offering palpably insane testimony at his trial, Ley was found to be insane only after statutory enquiry, following conviction and sentence of death. He eventually died in Broadmoor.

The Motive. The crime committed by a person of unsound mind is frequently without motive, or rather it is in opposition to anything that could be called a sane motive. A man, known to have been devoted to his wife and children, murders them; a fond mother kills her infant. It cannot be asserted as general propositions that persons who are sane never commit a crime without an apparent motive, and that, in the perpetration of a criminal act, an insane person either never has a motive or has one of a delusional nature only. In any such proposition the fact that no motive is discovered is taken as a proof that one does not exist. That motives, however, may exist without their being discoverable, is proved by the numerous recorded confessions of criminals before execution in cases in which, until the confession was made, no motive for the crime was discovered.

. Crimes have sometimes been committed without apparent motive by presumably sane persons who were at the time perfectly aware of the criminality of their conduct. No indication of insanity or of delusion could have been discovered, and they had nothing to say in their defence; they have, however, been held responsible. On the other hand, patients in a mental hospital have been known to be influenced by motives in the perpetration of crimes; thus they have sometimes murdered their nurses in revenge for ill-treatment. An absence of motive when there are indications of insanity is a presumption in favour of insanity; but the non-discovery of a motive for a criminal act cannot of itself be taken as a proof of the existence of insanity or homicidal mania. On the other hand, the existence of such a motive (jealousy or revenge) as would instigate a sane man to commit murder, is not of itself a proof that the person is sane and responsible.

[1] The Trial of Ley and Smith. "Notable British Trials" Series. Vol. 69, (1947).

A young imbecile had childish manners, and among the symptoms of imbecility was a strong propensity for watching windmills. He particularly wished to be tied to one of the arms of the mill when they were going round; he would go any distance to see a windmill, and would sit watching one for days together. His friends removed him to a place where there were no mills in the hope that this strange propensity would disappear. He collected a number of matches and set fire to the house where he was living in order to escape during the confusion to some imaginary land of windmills. On another occasion he enticed a child into a wood, and, in attempting to murder it, cut with a knife and mangled its limbs.

How would any sane person have connected this propensity for windmills with the attempts at arson and murder? Yet it turned out that he had decided to commit these crimes in the hope that he would be removed to a place where there was a mill; and in such a place he was placed under treatment. He had employed definite means to secure a definite result; and he succeeded.

A further example is provided by the case of Straffen to which reference has already been made.[1] Straffen gave as his motive for committing the second murder, a desire to annoy the police, whom he considered had always "had a down" on him. His second victim was a child who was completely unknown to him.

Another general observation is that an insane criminal very rarely murders in order to acquire property; almost invariably his motive is simple and personal, such as revenge or a wish to take life.

In *R. v. Bond*, a plea of insanity was raised in somewhat unusual circumstances. The accused, who was sixty-three, was charged with having committed indecent assaults upon a number of little girls. Only two charges, however, were proved, and the facts alleged were substantially admitted.

An experienced psychiatrist said that he had examined the accused and found him suffering from senile brain decay, with inability to manage himself. He was suffering from vascular degeneration of the body and brain, as evidenced by the actual state of the arteries, attacks of giddiness with temporary confusion and loss of memory, and numbness of his limbs, which had progressed during the last eighteen months. The accused was undergoing progressive deterioration. When questioned as to the acts complained of, he was not able to verify or to deny them. His will power was defective, and he suffered from constantly recurring ideas of a perverse sexual nature which were imperative and uncontrollable. The accused was aware of the immorality and illegality of the acts attributed to him. He required medical supervision and treatment. The witness was prepared to give a lunacy certificate in such a case.

Mercier gave evidence to the like effect, and stated that he would probably have given a lunacy certificate in the circumstances.

The victim (or victims), and the number of them. The victims of a sane criminal are those who oppose his desires or his wishes, whereas the victims of a person of unsound mind are very frequently those who are either indifferent to or who are the most dear to him.

Where a sane criminal commits a murder, one person, or at the most two, may be killed; but, in cases of homicidal mania, it is not unusual to find a wife and several children killed by the husband, or four or five children simultaneously killed by the wife. These atrocities are as common among those who are insane as they are unusual among the sane. No motive other than that of an insane delusion could be suggested for such a series of murders. For example, several infants may be murdered by a mother, who admits the act, but endeavours to account for it by asserting that she wished to convert them into angels, or to save them from destitution or exposure to worldly temptations.

The following is a typical case of absence of motive:

[1] The Trial of John Thomas Straffen. "Notable British Trials". Vol. 80 (1954).

A clerk aged thirty-two was charged with the murder of his two children, a girl aged five and a boy aged three. No motive for the crime could be ascribed as the accused was a devoted father and husband, and was not addicted to drink or to any bad habits. During war service in the East he had suffered severely from malaria. The prison surgeon stated that in his opinion the malaria would be a contributing factor in developing latent epilepsy. Without hearing the evidence for the defence, the jury found the prisoner guilty but insane.

The subsequent conduct of the Accused. He rarely seeks to escape, but delivers himself up to the police, and acknowledges the crime with which he is charged. This is a common feature of homicidal mania. A sane criminal usually attempts to conceal all traces of the crime, and he usually denies it to the last.

On the other hand, it sometimes happens that sane persons who take the lives of others through revenge or anger, commit the murder openly, and make no attempt to deny or to conceal the crime, for the simple reason that denial or attempt at concealment would be hopeless.

Again, a morbid love of notoriety has been known to induce a sane criminal to attempt assassination in circumstances where the attempt must necessarily be witnessed by hundreds of people, and where there can be no possibility of escape.

In *R. v. Harold Jones,* the prisoner, a lad aged fifteen, pleaded guilty to murdering a little girl. He had confessed to having killed another child six months before. He had been acquitted by the jury on the first charge; and when he returned to his native town he was made the object of a friendly demonstration by the inhabitants. This seems to have affected his morbid vanity, and to have led to the second murder. There was evidence that the lad was suffering from disease of the mind in which there was a strong sexual element of abnormality.

GENERAL SUMMARY AND CASES

Medical Attitude to the McNaghten Rules

It is difficult for a doctor writing on the McNaghten Rules to refrain from a critical essay directed towards those features in which the Rules offend against modern concepts in medical psychology. Both the author of the present chapter, and colleagues in the medical profession, have written elsewhere of their views on the McNaghten Rules and the improvements which might be made in the criminal law in this respect. There have been a great many contributions by medical men on this subject; they are to be found as single articles or included in books. Only a few of the most recent are listed below.[1] This is not the place to go into such matters fully. Differences in outlook between medicine and the law do not alter the fact that, whatever their opinion of the validity of legal concept as they now exist, medical men like all other citizens are bound to respect the law and to address themselves to comply with it when, for example, they have to give evidence in a particular case.

Psychiatrists, when called as witnesses, must not argue about principles, but must confine themselves to an elucidation of the facts of the case for

[1] Hobson, J. A., Address to Howard League for Penal Reform. *Lancet* 1955. 1. 658.
Mayer Gross. W., Slater E., Roth M., "Clinical Psychiatry". London 1954.
Overholser W., "The Psychiatrist and the Law". New York. 1953.
Slater, E. (1954). *Brit. med. J.,* 713. 4890.
Stafford-Clark D. "Psychiatry Today". *Pelican Books,* 1952.
Stafford-Clark D. The McNaghten Rules. Article in *The Observer,* July 5th 1953.

the guidance of the Court. Any interpretation of the law rests with Her Majesty's Judges themselves and with nobody else. It is no function of the psychiatrist to argue in court against the law as it stands, however strongly he may feel about it, and in no circumstances should he allow his emotions to colour his judgment on the particular case on which he is engaged. He must remember that he is called as an expert to help the Court and is entitled to no more reverence or respect than the soundness of his evidence can command. It must be remembered however that the legal presumption that a man is not only innocent until he is proved guilty, but completely sane until he is proved to be of unsound mind, should not be taken to mean that the presumption of sanity entitles lawyers to dismiss evidence which conflicts with their common sense or observation. If the psychiatrist is going to be believed only when he says something which everybody else can see for himself, his rôle as an expert witness must necessarily lose much of its value.

Effects of Accused Person's Mental State upon Criminal Procedure

Preceding sections have dealt with the concept of criminal responsibility of insane persons in its application to those already charged with an indictable offence. As we pointed out at the beginning of this section, a plea of insanity may be raised by way of defence to any criminal charge; it remains necessary to consider other ways in which an offender's mental state is likely to be taken into consideration in the administration of justice.

This may happen at any one of four stages:—

1. During the stage of police enquiries.
2. On arraignment.
3. In the course of trial.
4. After conviction and sentence.

1. *During the stage of police enquiries.* For relatively trivial offences, and in cases where the offender is demonstrably insane, the police or the Director of Public Prosecutions may be satisfied that admission to a mental hospital, as a voluntary or certified patient, will effectively safeguard both the offender and the public from further offence. In such a case no charge may be preferred. Occasionally a prosecution which has been begun may be abandoned without the case coming to trial, when the offender is to be admitted to a mental hospital under circumstances such as those described above. This possibility allows the exercise of considerable discretion and commonsense by all concerned, but is customarily confined to offences which are not serious at law.

2. *On Arraignment.* In courts of summary jurisdiction it is most unusual for sentences longer than six months to be imposed. It is therefore not open to magistrates to find the accused guilty but insane, which would necessarily lead to an indefinite period of detention as a Broadmoor patient. What the magistrate can do, however, if he believes that the accused should be dealt with as an insane person, is to make a Reception Order, if he is satisfied that the accused did the act charged, and has evidence of two medical practitioners that the accused is of unsound mind. This Order, which can be made under Section 24 of the Criminal Justice Act, 1928, has precisely the same effect as that of a Summary Reception Order under the Lunacy Acts.

An alternative procedure, if the magistrate is in doubt about the accused person's state of mind, is to remand him for a psychiatric report, before proceeding with trial or sentence. This may decide him to forego the award of

punishment, but put the accused on probation on condition that he receives the appropriate psychiatric treatment. Under the Criminal Justice Act, (1948) this can take the form of inpatient treatment as a voluntary patient in a suitable hospital or clinic, or of outpatient treatment. Such a condition may not be imposed for a period of longer than one year.

In the case of indictable offences the magistrate will normally refer the prisoner for trial at a higher court such as an Assize Court, and there insanity may be put forward as a plea in bar of trial. It is always open to the defence to contend that the prisoner is unfit to plead, and this means in fact that the jury must be satisfied on the evidence of the prison Medical Officer, who has seen the patient on remand, or upon the evidence of other doctors called by the defence, that the prisoner is sufficiently insane to be unable to understand evidence, instruct counsel, or follow the processes of trial to an extent compatible with the principles of British justice. If the prisoner is so found, his trial is postponed *sine die* and he is sent to a hospital for the criminally insane to be detained during Her Majesty's pleasure. Theoretically, on recovery from his insanity and discharge from such hospital, he can once more be brought to trial. But in practice this has never happened in the United Kingdom.

In most cases where the insanity of the accused has reached a certifiable degree, such a plea in bar of trial will be accepted without question. Evidence of insanity must always be called by the defence, and cannot be put forward by the prosecution. However, it is most uncommon for the prosecution to contest it, and the normal procedure is for the judge to direct the jury to return a verdict of insane on arraignment. A remarkable exception to this normal procedure occurred in 1950, in which two juries, on the direction of the judge, found an accused man fit to plead, despite evidence by two doctors on the first occasion, and three on the second, that he was insane and unfit to plead. He was subsequently convicted of murder and finally executed after a Statutory Enquiry had been held.[1]

3. The third stage in the administration of justice in which insanity of the accused is liable to be considered is *in the course of the trial itself*. This has been dealt with in detail in the preceding section.

4. *After conviction and sentence.* At any time after conviction a prisoner may be found to be insane and recommended for certification by the prison Medical Officer, who also has this power in the case of prisoners awaiting trial on remand.

A special Statutory Enquiry may also be ordered by the Home Secretary in any case where there is reason to question the sanity of a prisoner under sentence of death. This is an enquiry held by two or more medical practitioners, customarily experts in their field, who have access to all the evidence in the trial, but may also consider every other relevant fact about the prisoner, his personal and family history, and information obtainable from others about him, which may not of itself have been admissible evidence in the trial.

This combination of the provisions of the Criminal Justice Act and the McNaghten Rules, together with the Statutory Enquiry, emphasizes the importance attached to the state of mind of any prisoner in determining the legal procedure adopted in his case. It is therefore the duty of the medical witness to offer a truly expert, impartial, balanced and wise opinion, and the duty of the lawyer to give this opinion the careful attention and respect which it should deserve.

[1] *R. v. Rivett*. Norfolk Assizes, 1950.

Conclusions

As a result of the researches of psychiatrists who have been studying problems connected with the insane, and of psychologists and humanitarians who have promulgated new views on the subject of the reform of criminals, the views formerly held as to the criminal responsibility of the insane have been modified during the past fifty years.

Whereas "madhouses" were formerly conducted for private profit, mental hospitals are now managed by the National Health Service, employing adequate medical talent with excellent results. Formerly, long terms of penal servitude, solitary confinement, and prison discipline, were considered to be the only methods of dealing with criminals; but it is now being taught that *less unsatisfactory results can be achieved by means of education and compulsory training accompanied by appropriate supervision and discipline.*

Sanity and insanity are regarded no longer as matters of simple fact, but as matters which call for trained observation. That certain people are sane and that certain others are palpably insane may be a fact; but there is nothing except conduct to *prove* whether those on the border line are sane or insane.

In this connection, the law of England divides insane persons into two classes: (a) those upon whom the sanctions of the criminal law have no effect, and whom therefore it would be cruel to punish; and (b) those whose form of insanity is only such that, to use Lord Bramwell's apt test, "they would not have yielded to their insanity if a policeman had been at their elbow."

If the punishment of death were abolished, it is probable that the plea of insanity would rarely be raised. In this connexion, Professor Kenny wrote: "Careful observation of insane patients, in various countries throughout many years, has now thrown light upon the mental processes of the insane. The world, it is now recognized, is full of 'warped' men and women in whom there exists some taint of insanity, but who nevertheless are readily influenced by the ordinary hopes and fears that control the conduct of ordinary people. To place such persons beyond the reach of all fear of criminal punishment would not only violate the logical consistence of our theory of crime, but would also be the cause of actual danger to the lives and property of their neighbours. Where insanity takes any such form, it comes clearly within the rule of criminal legislation propounded by Bain: 'If it is expedient to place restrictions upon the conduct of sentient beings, and if the threatening of pain operates to arrest such conduct, the case for punishment is made out.'"

In giving an opinion of the mental condition of an accused person, a medical witness should not modify that opinion, having regard to the *punishment* which may follow if the plea be rejected, but should confine his opinion to the medical *facts* of the case. A medical witness is summoned to a court of justice in order to assist the judge and jury in their deliberations. The question proposed to him involves a simple fact, and not its consequences. The determination of the question whether the accused *is a responsible agent is of a judicial nature*; medical evidence should be confined to the question whether the accused is *insane as defined by law.*

In practice as we have seen, even the rigidity and artificiality of the McNaghten Rules are to some extent mitigated by two important factors: the liberality with which they are usually interpreted by judges and applied by juries; and the existence of the Home Secretary's power to appoint a Statutory Enquiry to determine the sanity of any prisoner under sentence of death.[1] In the light of their subsequent report the Home Secretary may either order the prisoner's

[1] *Vide* p. 580, *supra.*

removal to Broadmoor, or, if the findings justify it, recommend exercise of the Crown's prerogative of mercy, in the form of a reprieve. In this way a miscarriage of justice may be averted.

Illustrative Cases

The following cases not only illustrate the above propositions, but indicate the sort of line which lawyers may be expected to take, and the form of examination and cross-examination which medical men must be prepared to undergo.

The case of Rex v. Heath.[1]

In the notorious case of Neville Heath, a man of 29 was charged with the murder of a young woman in a London Hotel. Her naked body was covered with marks of laceration from a leather bound metal tipped riding whip, her ankles were bound, her breasts savagely bitten, and there were extensive internal injuries inflicted through the vagina. Death had occurred from suffocation, probably with a pillow, but most of the injuries had been inflicted while the victim was still alive.[1] The crime was typical of a sadistic murder.

It was alleged that after the murder Heath had travelled down to Worthing where he renewed an association with a girl to whom he was unofficially engaged, whilst the entire police force was searching for him. From Worthing he went to Bournemouth, staying in a hotel under an assumed name where a few nights later he met his second victim, another young woman whom he murdered in a similarly brutal and sadistic fashion, leaving her naked body covered with some of her clothes and some brushwood in Branksome Dene Chine, where it was not discovered for several days.

At his trial he was, of course, charged only with one murder, the first; but the defence brought up the details of the second to support a plea of insanity. The precise nature of this plea varied during the course of the trial: at one time it was stated on behalf of the accused, who was not called to give evidence himself, that he was suffering from moral insanity; later his condition was described as one of moral defectiveness, and when the medical witness for the defence was cross-examined on this point by the prosecution, the suggestion of moral insanity was once again substituted for moral defect. Excerpts from this cross examination are particularly informative:

Cross-examined by Mr Hawke—Doctor, may I take it from your evidence that at the time Heath murdered Margery Gardner he knew that he was doing something that was wrong?—No.

May I take it that he knew what he was doing?—Yes.

That he knew that he had bound and tied a young woman lying on a bed?—Yes.

That he knew he had—we do not quite know which—either gagged or suffocated her by keeping her head pressed down while she was tied up?—Yes.

That he knew when he inflicted 17 lashes upon her with a thong that he was inflicting 17 lashes with a thong?—Yes.

He knew all those things?—Yes.

But he did not know that they were wrong?—He knew the consequences.

I did not ask you that, you know, with great respect?—He did not consider it wrong, no.

"Did not consider" is not the question that I asked, with great respect. I asked you whether he knew?—No.

When he suffocated that woman, lashed her, having tied her up and made her helpless first, he knew it was wrong?—No.

Would you tell me why?—Because people during sexual behaviour generally consider what they are doing is right and their own business.

Then I may take it this is your evidence. At the time he was inflicting these injuries he thought it was right?—He thought it was—yes, he thought it was right.

He thought that it was right?—Yes.

Did he think it was right, in your opinion, because he is a perverted sadist?—Yes.

A person, therefore, who acquires his sexual satisfaction from inflicting cruelty?—Yes.

Because he could only satisfy his sexual satisfaction by inflicting cruelty, you say that he thought it was right to inflict it, do you?—Yes, I do.

Is that your answer, Doctor?—Well, he was doing what he wished to do. I asked if that was your answer?—If you like, yes.

That inasmuch as he desired to satisfy a perverted lust he thought that it was right to satisfy it?—Yes.

And therefore he did not know that what he was doing was wrong. It that accurate?—Yes.

Are you saying, with your responsibility, standing there, that a person in that frame of mind is free from criminal responsibility if what he does causes grievous bodily harm or death?—At the time, yes.

His criminal responsibility does not arise at a particular time. I asked whether, with your responsibility, you say that a perverted sadist who knows perfectly well what he is doing when he satisfied his perverted instinct is free from criminal responsibility because he finds the necessity to satisfy it?—My answer is "Yes", because on questioning sexual perverts they appear to show no regret or remorse quite frequently.

Would it be your view that a person who finds it convenient at the moment to forge a cheque in order to free himself from financial responsibility is entitled to say that he thought it was right, and therefore he is free from the responsibility of what he does?—He may think so, yes.

Do you say that the person who has been proved to commit forgery for the purpose of improving his financial stability is entitled to claim insanity within the McNaghten Rules as a defence?—I think he does it because he has no strong sense of right and wrong at all.

With great respect, Doctor, I did not ask you what he thought. I asked you whether you thought he was entitled to claim exemption from responsibility on the ground of insanity?—Yes I do. I think if a man commits crimes in most fields and then the most peculiar and horrible crime and crimes, he does consider he is entitled to do so.

You are saying that a person who does a thing which he wants to do because it suits him at the moment to do it is entitled, if that thing is a crime, to claim that he is insane and therefore free from responsibility?—If the crime and the circumstances are so abnormal and unthinkable to the ordinary person, I do.

Later in cross-examination, after going over the previous history of the accused, which had been put forward by the defence, and included a number of instances of deception, false pretences, and fraud, Counsel endeavoured to obtain from the medical witness a precise statement of the type of insanity which was alleged to excuse the accused from responsibility:

I asked you whether you were prepared to take the view that if a person who commits a crime says that at the time he committed it he found it convenient to do so he is entitled to say that he was insane, and you say "No, except when that is coupled with some sexual perversion," as I understand it?—Well, there is such a thing as moral deficiency, moral insanity, and that is shown by offences in all fields, not just sexual.

Are you saying that this man is a moral defective?—Yes.

I want to understand that. Are you saying that this man is in law a moral defective?—Yes.

Are you really sure about that in your own honest opinion?—Yes, I am.

You are honestly of opinion and you are saying so now, that this man is in law a moral defective?—Yes.

Are you acquainted with the Mental Deficiency Act?—Yes.

Of course, I did not mean that offensively, Doctor, because of course you are. It was to draw your attention to it. Of course you know, nobody better, the Mental Deficiency Act of 1927?—Yes.

Was that an Act which was passed to, among other things, clearly define what persons should be considered to come within certain limits of mental derangement?—You asked me for my opinion. I know the age of 18 . . . .

You are anticipating me a little. I asked you whether you would tell me what the object of the Mental Deficiency Act was. Did I describe it fairly accurately?—Yes, definitely.

You see, I think you see the question that I am shortly going to ask you. You said that in your opinion this man is in law a moral defective. It follows, I take it, as you have given a conscientious answer, that you are acquainted with the definition of "moral defective" which is clearly laid down in the Mental Deficiency Act of 1927?—Yes.

May I read it to you: "Moral defectives, that is to say, persons in whose case there exists mental defectiveness coupled with strongly vicious or criminal propensities and who require care, supervision and control for the protection of others." *So far so good*—"For the purpose of this section, 'mental defectiveness' means a condition of arrested or incomplete development of mind existing before the age of 18 years, whether arising from inherent causes or induced by disease or injury." Have you any evidence whatsoever of any vicious or criminal propensities indicated by this man before he reached the age of 18, or a good bit later?—I have no evidence one way or the other.

Then, in the absence of evidence one way or the other, I take it you would be inclined to accept the researches that have been made by the responsible officer into his past history?—I would say according to that he was morally insane—a case of moral insanity.

You know, with respect, that is not what you said before. You said that he was a moral defective, and I wondered why. He cannot possibly be a moral defective, can he?—It is difficult to prove.

Mr. Caswell—I am sorry to object, my lord. This witness referred to "moral insanity." That is what he said to me.

Mr. Hawke—He did not say that to me.

Mr. Caswell—My learned friend has been cross-examining him as if he said "moral defective."

Mr. Hawke—I think my learned friend—I am sure through no fault of his; it may have been my fault or the witness's—did not hear the answer which Doctor—clearly gave me. I asked Doctor ——— whether he said that this man was a moral defective and his answer was "Yes."

Cross-examination continued—I am asking whether in your serious view as a matter of law this man is a moral defective?—In a matter of law he is morally insane. As a specialist in this type of illness I believe that this type of moral insanity dates from early years, and you asked me what I thought.

It may be my fault, and you may have misunderstood my question. You want to alter your previous answer to me, that you consider that in law this man is a moral defective?—In law, morally insane.

You said "moral defective" just now. Do you want to alter that?—No. My opinion is that the condition was present before the age of 18, which is purely arbitrary.

Do you take the view that there is any evidence at all before the age of 18 of any criminal propensities here whatever? I will put it to you if you question it. Do you know he was born on 6th July, 1917, at Ilford? You were not there, of course, but you have heard it stated?—Yes.

Do you know that he was educated at school and left school at the age of 17½, and then entered the Artist's Rifles?—Yes.

Got a short-service commission in the R.A.F. at the age of about 18. What possible evidence is there of any criminal tendency of any kind *in this man* before he reached the age when he was out in the world and sometimes found himself hard up and drew cheques which were not met?—In law, as I stated, it is a case of moral insanity.

Can you tell me why?—Because there is gross sexual perversion, and there is a long history of delinquency in other fields.

This delinquency in other fields, as you have described it, consists mainly of living from time to time by dishonesty. You do not call that moral delinquency in the sense of a disordered mind, do you?—

Mr. Justice Morris—"Moral insanity," he called it.

Cross-examination continued—I thought he used the term "moral delinquency." Do you call that moral insanity?—Yes.

What! Moral insanity when a man cannot pay his bills at an hotel and so runs up credit there and then gives a cheque which is not any good?—If he does it repeatedly.

Do you call that moral insanity? If it is done repeatedly over a long period and that is coupled with gross sexual perversion, I think it comes under the heading of moral insanity.

Is there any evidence of any of this history being coupled with gross sexual perversion? Well, there are two murders.

I said "this history." I am not talking about the recent times?—There has been no evidence brought forward, no.

By Mr. JUSTICE MORRIS—I just want to get it quite clear. What do you mean by "moral insanity"?—A man who is not able to appreciate the difference between right and wrong, and particularly does not fully appreciate that other people do not hold his own views.

Cross-examination continued—I think I need trouble you a little further. I took down an answer of yours to my learned friend in these words: "I found nothing to show ordinary insanity." Is that right?—Ordinary insanity, yes.

Is there any evidence, therefore, that this man is suffering from a disease of the mind?—Yes. By "ordinary insanity" I was meaning disease of the mind of quite a different type.

Are you saying more than this—and if you are, tell me—that this man is not a normal person?—I am, yes.

You appreciate, of course, that I, if I may say so, would be the first to concede that he is certainly not a normal person?—I do.

You would agree with me that it is no answer in law for an abnormal person who gratifies his abnormality to say that he is entitled to be excused from it?—It depends on its degree, its type, and how large the field covers.

But, Doctor ——, with great respect, does it? What we have to consider is whether that person either does not know what he is doing—which you say is not the state that exists here?—Quite.

Or, knowing what he is doing, does not know or appreciate that what he is doing is wrong and punishable by law?—Yes. He may know it is punishable by law, but he does not think it is wrong.

Well, does that mean "morally wrong"?—Morally wrong, yes, as far as he is concerned.

Are you saying he is entitled to be excused because he does not think it is morally wrong?—No, I do not.

I must confess I was surprised—Homosexuals do not consider themselves morally wrong, but they are punishable by law.

Dr. —— you have introduced that. I have rather carefully avoided it. The homosexual finds his satisfaction also in a perverted way. Very often when he satisfies it in that perverted way he offends against the law, does he not?— Yes.

Is it your view that every homosexual who offends against the law, then, is entitled to say: "I am not responsible for what I did because I thought at the time I wanted to do it, and therefore it was right, and therefore I am insane"?—No certainly not.

Then what is the difference, with great respect?—Well, there is such a condition as moral insanity. Moral insanity covers the case of a man who will commit any offence which he feels at the time he wants to.

If any perverted person feels at the time he wants to satisfy his perversion, you say he is entitled to say he is insane?—With other offences, not the one.

Rebutting evidence was then called from two medical officers in H.M. Prison Service. They both agreed that while the accused was an individual of psychopathic personality, he could not be regarded as insane under the McNaghten Rules.

In his summing up Mr. Justice Morris reminded the Jury that Heath had discussed the first crime with his erstwhile fiancee, before committing the second, in terms which left no reasonable doubt that he knew that what had been done was wholly wrong. It had not been seriously contested that at the time when he did these things he had not known what he was doing. The Judge went on to say:—

"If you accept on the evidence that the accused man, who, the defence invite you to say, killed that other woman that night, took steps to conceal the body so that its discovery might be delayed, as indeed it was, as you have heard from the evidence, do you think that from that incident you get any help one way or the other to decide in regard to the mind of the accused? Does that not indicate that the accused did not know that what he was doing was wrong?

It was elicited by the defence that after the killing of this woman, Miss Marshall, he had taken from her the return half of a first-class railway ticket from Bournemouth to London. It might have been useful to have. Was the act of taking that return half of the railway ticket the act of a man who did not know the difference between doing right and doing wrong?

It is said, and you will consider it, 'Well, but he showed no remorse. He showed no fear. He did stupid things.' Again these are questions for you."

And in conclusion, after further detail and careful review of all the evidence—

"Members of the jury, I have done my best to assist you in the approaching of your task to have in mind what is the matter about which you are invited by the defence to pronounce. The defence have invited you to consider all these matters, and as they have, you will I am sure consider them. Do they, when examined and sifted and tested, give you the picture or do they not of a man who was insane in the sense that he had a disease of the mind causing a defect of reason resulting in his not knowing that what he was doing was wrong? Or do they reveal a man who must have known that what he was doing was wrong?"

After an hour's absence the jury returned a verdict of guilty. There was no appeal, and the report of the statutory enquiry suggested no grounds for reprieve. The prisoner was executed.

This case brings out a number of important points, which may be summarized as follows: neither psychopathic personality, nor sadism, can be accepted as mitigating responsibility in Law. Moral insanity, which is only another name for psychopathic personality, cannot be regarded as insanity in the legal sense at all. Moral defect on the other hand has a legal definition, which can be accepted as a medical diagnosis only if the statutory requirements of the definition are completely fulfilled.

The full account of the trial, published in Notable British Trials Series, Volume 75, should be studied in detail by all interested in seeing the technique of examination and cross-examination of a medical witness perfectly exemplified. The inability of a medical witness for the defence to get round the McNaghten Rules when they are skilfully and fairly made the kernel of cross-examination, emerges with striking effect. The importance of medical evidence in rebuttal and the care with which all medical evidence is sifted, is also vividly brought out.

Other recent trials which illustrate the same points, and are published in the Notable British Trials Series are those of Haigh and Christie, which are also worth the reader's attention.

In *R.* v. *Rodgers*, a boy aged 15, was charged with murder of his mother, who was an habitual drunkard.

The elder sister related how that she, the accused, and a little sister, had supper together on the evening of the 12th, the mother being in the room under the influence of drink. After supper the accused entered the drawing room with a revolver in his hand, and exclaimed, "I have shot her. I thought it best." Later that night the accused said that he did it for the sake of the little sister, who, he said, could not be brought up to the life they had led for the last few years.

In cross-examination, another witness (a brother) said that the accused had been strange in his behaviour for about six weeks before the tragedy. He had strange fancies, and one morning at breakfast said he had dreamed that he had strangled his mother.

The family physician said that he had noticed the accused's extraordinary behaviour. After the tragedy the boy told him that he distinctly heard a voice tell him to do it quickly.

An expert in mental diseases gave his opinion that the boy was of unsound mind when he shot his sister.

The Judge: Do you mean there was a warping influence greater than or other than the influence of passion?

Witness: Yes.

In cross-examination, witness said the murder was not merely an act done on the impulse of the moment, but that it was an act which the prisoner had considered beforehand.

Similar evidence was given by two other experts in mental diseases. One of the latter said: "I consider him not to be of sound and right judgment, but find

(1) *R.* v. *Heath*, "Notable British Trials" Series: Vol. 75, 1946.
(2) *R.* v. *Ley and Smith*, "Notable British" Trials Series: Vol. 69, 1947.
(3) *R.* v. *Haigh*, "Notable British Trials" Series: Vol. 78, 1953.
(4) *R.* v. *Straffen*, "Notable British Trials" Series: Vol. 80, 1954.
(5) *R.* v. *Christie*, "Notable British Trials" Series. (in press) 1955.

no other definite symptoms of insanity at the present time from my conversation with him. Giving all weight to the circumstances within my knowledge, I have formed the opinion that at the time of the commission of the act he was in a state of morbid mental exaltation, during which he made some effort to resist, and at last suddenly yielded to a recurrent impulse to commit a crime for which an immature judgment had for some time led him to believe there was moral justification."

Evidence of insanity on the mother's side was given by a brother of the deceased.

The husband of the deceased said that he took the house in the country because of home troubles. He thought that his wife would be away from the means of getting drunk. Great affection had existed between the accused and his mother.

The jury found the prisoner guilty, but insane.

In *R.* v. *Phippard*, (1954) the accused had murdered his wife suddenly in the middle of a Saturday afternoon while she was doing the washing-up.

The family history revealed no evidence of insanity, but an exhaustive enquiry could not be made owing to the absence of informants on his side of the family. In his personal history he had always been a somewhat solitary suspicious individual. As long as 20 years before the crime of which he now stood accused, he had a period of several months during which he had been convinced that one of his brothers was carrying on a love affair with his wife, and that his mother, to whom he was devoted, was conniving at this affair, and endeavouring to get him out of the house so that it could continue. From his own testimony he would never appear to have found any evidence that any of this was true, but even in retrospect he saw no reason to doubt it.

For some six to nine months before the commission of the act with which he was charged, he had continually accused his wife of having a sexual relationship with their eldest son, a boy of 18. He was not himself placed in the witness box, but a psychiatrist called by the defence gave evidence that the accused had supported these accusations by a number of bizarre assertions, and conclusions based upon them; for example, that when his wife put the cat out at night, she was putting the animal out to find out where he, the accused, was hiding. He was in fact hiding behind the chicken house in the garden expecting to observe his wife and son embracing through the kitchen window. He interpreted her action in putting the cat out as proof that she was both guilty of the intentions which he suspected, and aware that he was in hiding and wishing to observe her.

On another occasion he went and hid in broad daylight under his own and his wife's double bed, in their bedroom, in anticipation of his son's coming home from work at lunchtime and taking the wife upstairs to the bedroom to have intercourse with her. When in fact the boy came home at lunchtime and went straight up to his own room, passing the open door of the room wherein his father lay concealed, the father at once assumed that the boy had seen him lying in concealment, and that his failure to come into the room proved his guilt.

In the course of the witness's *examination of the prisoner during his remand* in prison prior to the trial, he said that he knew his wife had been "up to no good" because she had a skin rash which resulted in scales of skin falling from her body, and he had seen a continuous trail of these scales from his own bedroom in the direction of his son's bedroom. He had also noticed that the kitchen sink had contained what he took to be seminal fluid in large quantities, every morning when he went down to inspect it. The bizarre nature of these statements made it at least highly probable that they were delusional, *and the conclusions which he drew from them showed a disorder of thinking which suggested very strongly that he was insane.* Further examination put this beyond reasonable doubt, in the opinion of the witness.

At the trial the prison Medical Officer also stated that in his opinion the prisoner was insane. Counsel for the prosecution called no rebutting medical evidence but cross-examined both the prison Medical Officer and the psychiatrist called by the defence meticulously, with particular reference to the *strict application of the McNaghten Rules*. In his summing-up the judge said that in view of the clear and unanimous opinion of the medical witnesses and the failure of the prosecution to call any medical rebuttal the jury could not be left in any serious doubt as to the extreme medical probability that the prisoner was insane. On this clear direction the jury returned a verdict of guilty but insane.

Poisoning

The crime of poisoning indicates malice and deliberation to an extent usually held to be incompatible with a state of irresponsible insanity. For this reason, a defence of insanity in cases of murder by poisoning has generally ended in failure, even when there has been relatively strong evidence, both personal and hereditary, in support of the contention. In point of fact, it is somewhat uncommon for insane people to resort to poisoning, although there have been instances of their doing so.

In *R. v. Edmunds*, the accused woman (aged 43), who moved in a respectable sphere of society was charged with the murder of a boy at Brighton. The boy ate some sweets purchased in a confectioner's shop, and died in a short time with the symptoms of poisoning by strychnine; strychnine was found in his stomach.

The accused had procured sweets from this shop by the agency of boys; and, having deliberately added strychnine, returned the sweets to the shop. She had herself on various occasions left poisoned sweets about in shops. How many persons had suffered from this cold-blooded and reckless act is not known, but she had previously attempted to poison the wife of a medical man and she imputed the poisoning to the carelessness of the confectioner, but he was able to show that his sweets as purchased were wholesome. By a chain of circumstances the crime of poisoning was clearly fixed upon the accused. She had shown much cunning in her activities. She had procured strychnine on four different occasions under false pretences, had borrowed the poison-book of a druggist, and had torn out the leaves to conceal the fact that she had purchased the poison.

A defence of insanity was raised but there was no proof of insanity. The accused had shown all the skill of an accomplished criminal in carrying out her plan of general poisoning, and in using the most artful means to conceal it and to throw the imputation upon the confectioner. Impulse could hardly be pleaded, for her criminal acts were extended over weeks and months. She was convicted. Then, with a view to averting or delaying punishment, she put in a false plea of pregnancy in bar of execution. The capital sentence was subsequently commuted on the ground of insanity. Her father died in a mental hospital when of middle-age, having suffered for years from demonstrable insanity; her brother died as an epileptic idiot; her grandfather was a subject of cerebral disease; her sister suffered from hysteria; other relatives were afflicted with nervous diseases of some kind; and she herself appears to have exhibited, some eighteen years previously, symptoms of hysteria and hysterical paralysis. This hereditary tendency to insanity in her family was the main cause of the commutation of the capital sentence.

This case should be compared with that of Mary Ann Cotton, who was executed for murder by poison. This woman killed by arsenic, in the most reckless manner, children, husband, relatives and friends, to the number of twenty persons. She sent her son, for whose murder she was tried, to procure the poison with which she subsequently killed him; but this woman was condemned and executed. There was no evidence of hereditary predisposition in her case.

Insanity as a Defence in Sexual Crimes

The defence of unsoundness of mind is very occasionally advanced in sexual crimes other than murder. When the disorder of the mind is established from evidence of the general conduct and conversation of a person, no difficulty arises; but when, on a charge of rape, it is alleged that the assailant was unable to control his desires, it becomes a question how far such a defence is medically and legally admissible. Excessive amorous propensities may exist in sane and responsible persons, and, if unresisted by due moral control, they may in a certain sense be described as irresistible, but evidence to that effect would not justify a jury in finding an accused man not guilty in a case where the time and circumstances were especially suitable for committing

such a crime. The sane ravisher will generally seek his opportunity; the real maniac will attack any woman openly and indiscriminately.

Such a defence is rarely set up in a case of rape, for the reason, no doubt, that all the circumstances of the case would be adverse to it.

In a case tried at Glasgow, the defence of insanity was raised in a trial for criminal assault on a woman. The crime was committed on November 12th. On the following day, in his examination, the accused, a married man, aged 40, appeared to be calm and collected and in no respect different from other men. The account he gave of the transaction was that he thought he was under the influence of the magistrates, and that he would lose his life if he did not have connection with the prosecutrix. After a struggle together, he committed the act. His mother stated that he had been subject to epileptic fits, which left him in a stupid state and scarcely conscious of his actions. He also suffered from delusions. A few days before the commission of the crime, he had had several seizures of more than usual violence, and it was suggested that at the time of the act he was under the influence of some of his delusions. The jury returned a verdict of "not guilty on the ground of insanity".

The act was perpetrated with a proper attention to opportunity and under the same animal impulse as would have been manifested by a person not subject to epileptic fits. There was no proof that his insanity had shown itself on previous occasions in a sexual form; nevertheless, the history of the case suggests the possibility that the crime was perpetrated when the accused was in a bemused mental state from his epileptic fits.

Other Indications for Psychiatric Evidence

Apart from its contribution to the assessment of the effects of insanity and mental defect upon criminal responsibility, psychiatric evidence is becoming increasingly important and respected in other fields.

One of these is in the consideration of the disposal of prisoners convicted of offences in which evidence of neurotic illness, or disorder of personality and emotional disturbance, may be relevant. Such evidence is given with a view to the modification or variation of sentence, and may be accompanied by an undertaking that the accused will seek medical treatment, if given the opportunity. People charged with attempted suicide, or in conflict with the law because of alcoholism or addiction to drugs, provide examples. Other instances concern men accused of sexual offences, particularly of indecent exposure or, occasionally, of importuning with the intent to procure homosexual relations. In certain cases the court may consider that punishment is required, and perhaps that medical treatment when obtainable should be given in prison, or postponed until completion of sentence. But provided that evidence along these lines is offered objectively, is sensible and realistic, and is not accompanied by extravagant promises of success, it is likely to meet with sympathetic and imaginative reception from the majority of magistrates and judges.

extension of this principle to all psychiatric evidence, whereby such evidence is called *by the court*, rather than by counsel for one side or the other, and is subsequently subjected to cross-examination by both sides, has been recommended as a notable advance in criminal procedure.[1]

RESPONSIBILITY OF DRUNKEN PERSONS

The Effects of Alcohol on the Brain [2]

Alcohol produces a temporary alteration in the mental state, by a progressive interference with mental function. The earliest functions of the brain to the affected are those usually regarded as highest in the evolutionary state, such as the exercise of judgment, self consciousness, capacity for self criticism and restraint. More severe degrees of intoxication produce progressively increasing changes in mental and nervous function, culminating in complete loss of control with ultimately absolute unconsciousness which may deepen into coma and death.

The amount of alcohol required to produce any of these states varies with the age and state of health of the person as well as with his habits in relation to alcohol. For example, it requires a considerably greater quantity of alcohol to produce effects on a person accustomed to the use of alcoholic beverages than it does on a more temperate person. The effect, moreover varies in the same individual at different times.

Relative intolerance or undue sensitivity to the effects of alcohol may be constitutional, for example in epileptics or others with an unusually irritable unstable, or explosive type of brain function, whether congenital or acquired after injury or damage to the brain.

Continued excessive ingestion of alcohol may damage the brain and nervous system irreversibly, causing various forms of insanity, all of which overly progressive dementia. On the other hand mental illness or defect may themselves predispose an individual to excessive dependence upon alcohol, which may therefore be both a symptom and a cause of unsoundness of mind.

Delirium Tremens. This is by far the most common form of acute insanity seen in association with alcoholism. Its direct cause is probably a nutritional deficiency caused by, or associated with alcoholism, and involving vitamins of the B group. Similar vitamin deficiencies are found in association with other and more chronic forms of insanity due to alcohol.

The condition frequently follows either a spontaneous inability to continue to take alcohol, from failure or withdrawal of supply, or increasing nausea and vomiting, or some physical or emotional stress, or both. Injuries, infections, and shock can all act as precipitating agents.

Patients with delirium tremens are often violent and nearly always restless, impulsively overactive, confused, and unsteady on their feet. They are always a danger to themselves, sometimes to others; hence they require constant supervision. Such persons are incompetent in the performance of any civil acts, unless the mind should clear up before death: they are not responsible for criminal acts committed while they are labouring under an attack. The essential difference between delirium tremens and voluntary drunkenness in this respect is that the former is regarded as a disorder of the mind, while the latter is not.

[1] *Clinical Psychiatry.* Mayer Gross, Slater, & Roth. Cassel, London, 1954. p. 579.
[2] *Vide* Savage on "Insanity"; Maudsley, "Responsibility in Mental Affections."

DIAGNOSIS OF DRUNKENNESS

For a description of the effects of alcohol and the diagnosis of drunkenness, see "Poisoning by Alcohol." Vol. II.

Intoxication other than Alcoholic

Intoxication is simply poisoning by alcohol, a form of narcotic poisoning. A medico-legal question may arise in reference to the responsibility of persons for acts perpetrated while they are under the influence of other narcotics of a more powerful kind. Acute confusional insanity may arise in predisposed persons from the effect of cocaine, belladonna, mescalin, chloral, cannabis indica, and many other drugs, and from the toxins of many acute fevers. In this state there is great disturbance of memory, disorders of judgment leading to delusions and marked hallucinations. There may be great excitement and restlessness, which, in turn, may be followed by drowsiness, stupor, and muscular weakness. As a result of his hallucinations and illusions, a man in this state, like an insane person, may commit illegal acts. Cases involving a question of this kind are not very common in England.

A woman was charged with the murder of a child by strangulation. There was no obvious motive, and at the time of the murder, the accused was in a half-stupefied or unconscious state. She was in the habit of taking laudanum, of which she had taken a large dose on the morning of the day on which the child was killed. It was suggested for the defence that she was in such a state of mind as not to be responsible, but the jury convicted her of the murder.

Unless there is proof of confirmed *disease of the brain as a result of the* habit, *a* person who commits a crime while under the influence of drugs voluntarily taken, will no doubt be held as responsible for the results as if he were sane.

Medical Views on the Criminal Responsibility of Drunken Persons

Savage[1] says: "A person, say, is given powerful stimulants, masked or concealed in some way; or being weak, or suffering from an old injury to the head, an amount which formerly would not have affected him now produces a great effect; in a state of acute alcoholism he commits a crime, and doubtless would be considered not guilty; but if he has experienced several times the danger which he incurs by taking stimulants even in small quantities, and yet continues to indulge, and then perpetrates a crime, he may be justly considered responsible, even although it may be proved that by inheritance, or in consequence of injury to the head, he is especially liable to be affected by stimulants. Next, if in consequence of intemperance he becomes slowly affected by mental disorder, and in a state of *delirium tremens* he commits a crime, he will probably not be considered fully responsible. If instead of *delirium tremens* alcohol produces chronic insanity, and in this condition of genuine insanity he does harm, he will not be considered responsible for his acts." Mercier[2] says: "If he takes drink not knowing that it will make him mad, he should not be held responsible. If he does know by previous experience that it will produce such a kind of madness as is likely to result in crime, he should be held responsible." The degrees of responsibility from

[1] Savage, G. H., 1890. "Insanity and Allied Neuroses". London: Cassell & Co.
[2] Mercier, C. A., 1905. "Criminal Responsibility". Oxford: Clarendon Press.

drink are here fairly stated from a medical point of view, but when a case is before a legal tribunal the problem does not appear so simple.

Legal Views on Criminal Responsibility of Drunken Persons

Voluntary drunkenness is not of itself sufficient to absolve from criminal responsibility. Involuntary drunkenness, i.e. where a man is tricked into taking too much, may excuse him.[1] Insanity, though temporary, brought about by drink, or delirium tremens due to drink, can be used as a defence in the same way as insanity from any other cause.[2] The above observations apply equally to mental or bodily conditions brought about by drugs. The case of *R. v. Beard* indicated clearly the difference between a defence of insanity produced by drunkenness and a defence that by reason of drink the mind could not form a specific intention. This case also deals with the general principles of drunkenness in relation to crime. The facts of Beard's case were as follows: The prisoner had been convicted of the murder of a child of thirteen. He ravished the girl while in a state of drunkenness; and, in furtherance of the act of rape, placed his hand on her mouth with a view to preventing her from screaming, with the result that the girl died of suffocation. The defence was that the man was so drunk that the jury ought to return a verdict of manslaughter. The judge who tried the case, directed the jury that this defence could prevail only if they were satisfied that, by reason of his drunkenness, the prisoner either did not know what he was *doing*, or did not know that what he was doing was wrong. Upon appeal the Court of Criminal Appeal followed the ruling in *R. v. Meade*,[3] and held that the judge ought to have put to the jury the further question whether the mind of the prisoner was so affected by drink that he did not know that what he was doing was dangerous.. In these circumstances the Court of Criminal Appeal substituted a verdict of manslaughter.

In delivering the unanimous decision of the House of Lords, in *Beard's* case, the Lord Chancellor laid down the following general principles: "Insanity, whether produced by drunkenness or not (even though temporary), is a defence; and drunkenness which renders the accused incapable of forming the specific intent essential to constitute the crime should be taken into consideration, with the other facts proved, in order to determine whether or not he had this intent. . . . This is not an exceptional rule, applicable only to cases in which it is necessary to prove a specific intent, *e.g.,* intent to do grievous bodily harm. . . . This, on ultimate analysis, is only in accordance with the ordinary law applicable to crime. For, speaking generally, (and apart from certain special offences), a person cannot be convicted of a crime unless the *mens* is *rea*. Drunkenness rendering a person incapable of the intent would be an answer; as, for example, in a charge of attempted suicide.... Drunkenness falling short of a proved incapacity to form the intent necessary to constitute the crime, and merely establishing that his mind was affected by drink so that he more readily gave way to some violent passion, does not rebut the presumption that a man intends the natural consequences of his acts."

In applying these principles to *Beard's* case, the Lord Chancellor said: "In the present case, drunkenness could be no defence unless Beard, at the time of committing the rape, was so drunk that he was incapable of forming the intent to commit it (which was not the fact). The capacity of the mind of

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[1] Hale, p. 32 *R. v. Pearson,* II Lew. C.C.
[2] *R. v. Davies,* 14 Cox. C.C. and *D.P.P. v. Beard,* (1920) A.C. p. 479.
[3] (1909) 1. K.B. 895.

the prisoner to form the felonious intent which murder involved is to be explored in relation to the ravishment, and not in relation merely to the violent acts which gave effect to the ravishment. Death caused by an act of violence done in furtherance of the felony of rape is murder. . . ."

In commenting on the judge's direction to the jury, the Lord Chancellor said: "The judge should not have introduced the question whether the prisoner knew that he was doing wrong in a defence of drunkenness where insanity was not pleaded. Nothwithstanding that the judges ever since *McNaghten's* case have used these questions as a test of insanity, there is no single case, where drunkenness has been the defence, in which the judge has directed the jury to consider whether the prisoner knew that he was doing wrong. The direction of the judge was an innovation not supported by authority."

The conviction of murder was restored.

An extremely unusual case of homicide which occurred when both the assailant and the victim were to all intents and purposes completely stuporose with alcohol, was reported in the *Police Journal* in 1954.[1]

A man called Donoghue killed his best friend Meaney by stabbing him in the head and neck under the impression that Meaney was a dummy, placed fully clothed upon Donoghue's bed as a practical joke. Both men spent the preceding evening drinking beer and gin in vast and equal proportions, both had retired to Donoghue's room to sleep it off, and Donoghue had awoken in the early hours of the morning with no recollection of the preceding events, still intoxicated, but finding himself wearing his clothes and sitting in a chair. On attempting to go to bed he had found "the dummy" lying there, he dragged it off to the floor, where it fell "like a sack of coal", then took up his bayonet (used for cutting bread) and stabbed it senselessly a number of times. He then dragged what he still thought was a dummy out to the landing, dumping it where it was found the following morning. When he himself awoke at 7.30 a.m. and saw blood all over the floor, he went on to the landing at the same moment as a neighbour came up the stairs. This, he said, was his first realization of what had really happened.

Donoghue's story was believed largely because in the course of autopsy on Meaney, the latter's blood alcohol figure was 347 mg. per cent, and the urine figure 450 mg. per cent. This represents a greater saturation than is compatible with life in many people, and as evidence was available that when last seen, Meaney had appeared to be the more sober of the two, the presumption was very strong indeed that Donoghue could not have had a lower alcohol saturation himself.

At the trial it was accepted on psychiatric evidence that, assuming Donoghue's blood alcohol to have been at least no less than the dead man's at the time of this incident—and it was probably appreciably higher—it must have been at a level where ordinarily a man is quite incapable of clear thinking, of forming a felonious intent, or harboring malice of the kind the prosecution would have to show in order to carry the case at trial on a charge of murder. The circumstances, the nature of the wounding, the absence of resistance, and the removal of the body dying or dead from the stab wounds all gave unequivocal proof of a felonious homicide, but was it murder? The question had to be resolved on the state of Donoghue's mind at the time.

(b) accused had killed his friend—with whom he had had no quarrel;

(c) he had made no attempt to evade responsibility;

(d) he had however pleaded from the start that he thought what he was stabbing was a dummy.

(e) The accused was too drunk to appreciate that the act in which he was indulging, involved the killing of a man.

Mr. Christmas Humphreys said that the Director of Public Prosecutions had considered there was insufficient evidence to proceed on a charge of murder and, in consultation with Mr. John Maude, was prepared to accept a plea of guilty to manslaughter. Dr. J. C. M. Matheson, Principal Medical Officer at Brixton Prison, who examined Donoghue on reception, had submitted the view "that the degree of drunkenness present at the time of the alleged offence was such that he could have mistakenly believed he was, in fact, stabbing a dummy and not a human being". The Judge agreed and Donoghue received a sentence of three years' imprisonment.

It will be observed that this verdict implies some malicious intent, otherwise the verdict should presumably have been one of guilty of the act charged, but temporarily insane through drunkenness.

In a limited class of case, for example in charges of murder directly arising from acts of violence done with intent to do grievous bodily harm, where it is established that the accused was drunk at the time of committing the acts, the presumption that he intended the natural consequence of his acts may be rebutted by showing his mind to have been incapable of knowing that what he was doing was dangerous, and the crime may be reduced to manslaughter,[1] but this is not of general application, and does not apply to charges of murder where the violent act is done in furtherance of what is in itself a violent felony, e.g. rape. In such a case drunkenness can be no defence unless it rendered the person accused incapable of forming the intention to rape.[2]

The case of R. v. McCarthy reported in "The Times" of 13th April, 1954, is useful in connection with drink and crime.

Civil Responsibility of Drunken Persons

Any *deed* or *agreement* made by a person when drunk is not invalidated by English law, except in cases where the intoxication has proceeded so far as to deprive him of all consciousness of what he is doing. The law will not interfere in other cases, unless the drunkenness was the result of collusion by others for the purposes of fraud. When the drunkenness has occasioned a temporary loss of the reasoning powers, the person is incapable of giving a valid consent, and therefore cannot enter into a contract or agreement; for this implies *aggregatio mentium, i.e.*, a mutual assent of the parties. In *Matthews* v. *Baxter*,[3] A agreed to purchase some houses belonging to B. At the time of the contract, A was so drunk as not to know what he was doing. Afterwards, when sober, he ratified and confirmed the contract. It was held that both parties were bound by the contract.

If the person contracting knew what he was doing, partial drunkenness does not vitiate a contract or agreement.

The liability to pay a reasonable price for necessaries sold and delivered to a drunken person is upon a contract implied in law, and does not depend on actual agreement, the existence of which is precluded by the mental condition of the person to whom the goods were supplied.

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[1] *R. v. Meade* (1909) 1 K.B. 895.

[2] *D.P.P. v. Beard* (Supra).

[3] L.R. 8 Ex. 132.

Care of Habitual Drunkards

The Inebriates Act, 1879 to 1898. The Inebriates Act of 1898 is no longer in effective operation, except in so far as it relates to licensed retreats, since state or certified inebriate reformatories no longer exist. There is only one licensed retreat operated under The Habitual Drunkards Act of 1879, which is a retreat for women at Spelthorne St. Mary, near Egham, in Surrey. It is licensed by the Surrey County Council and inspected annually by the Home Office Medical Inspector.

Those sections of the Acts which might still conceivably have some practical importance will be briefly summarized.

Voluntary applicants for admission to and detention in a licensed retreat can have their applications attested by one justice and the period of detention for which an applicant can apply is two years.

The period for which a licence for a retreat may be granted is also two years.

The licensing local authority in a borough, is the borough council and the town clerk, and elsewhere the county council and its clerk, a county council being empowered to delegate any of its powers as a local authority to a committee.

Power is given to any county or borough council, and to two or more councils in combination, to contribute to the establishment or maintenance of a retreat under the Inebriates Acts, 1879 and 1888, as amended by the Act of 1898.

The extension of a term of detention in, or readmission to a retreat may be granted on attestation by one justice, without a statutory declaration, the attesting justice not being required to satisfy himself that the applicant is a habitual drunkard.

The time between escape from and return to a retreat is not reckoned as part of the term of detention. A warrant for the arrest of a patient who has escaped from a retreat may be issued by any justice having jurisdiction in the place where the escaped patient resides.

A certificate must be issued by a duly qualified medical practitioner of the cause of death, with the name of anyone present at the death, and copies thereof must be duly certified by the person in charge of the deceased, and sent by that person to the coroner, to the district registrar of deaths, to the clerk of the local authority, and to the person by whom the last payment was made for the deceased, or to at least one of the persons who signed the statutory declaration under the Habitual Drunkards Act, 1897.

The Secretary of State is empowered to make regulations on all matters necessary or proper for carrying into effect the provisions of these Acts with respect to retreats.

In *Scott* v. *Wakem*, a medical practitioner was sued for damages for having placed the plaintiff under restraint, and without necessity or authority. The plaintiff had been subject to attacks of *delirium tremens*, and on the day in question the defendant was called in to see him. He found him in an excited state with loaded pistols in his hands, threatening to shoot his wife; two men were holding him. He was then in a fit of *delirium tremens*, and in a dangerous state. The defendant placed a man in the house to watch him during the night. The usual medical attendant of the family saw the plaintiff on the following day, and he found him then quite sane and sensible, and complaining that he had been kept a prisoner in his own house by order of the defendant. It was denied that any authority for interference had been given to the defendant by the plaintiff's wife, although the evidence that she had authorized the proceedings was very strong. The plaintiff, who recovered next day, brought an action for damages.

The judge who tried the case said: "If the defendant had made out that the plaintiff was, at the time of the original restraint, a *dangerous lunatic*, in such a state that it was likely *he might do mischief to any one*, he would be justified in putting a restraint upon him, not merely at the moment of the original danger, but until there was reasonable ground to believe that the danger was over; and this would sustain one of the pleas. Or, again, if the jury were satisfied that the wife of the plaintiff had called in the defendant to cure her husband under a fit of *delirium tremens*, and that he came in to cure him, and left him when he believed he had recovered, then the defendant would be justified in what he had done, supposing that in either case he had done nothing that was not necessary or reasonably proper under the circumstances. Again, if the defendant had been called in on behalf of and for the benefit of the plaintiff, and to cure him under a fit of *delirium tremens*, and when the plaintiff recovered he himself approved what had been done, that would likewise afford a defence, supposing that nothing more than proper treatment had been adopted."

The plaintiff was awarded a farthing damages, but the medical man was necessarily put to great expense in defending the action.

Syrun v. *Fraser and Andrews* was of a similar nature.

The plaintiff was a woman who gave way to habits of drinking: she had had an attack of *delirium tremens* two years before the trial. The defendants were called in, and attended her professionally. At the plaintiff's own request a nurse and a male attendant were provided for her by a friend, and they stated that they merely followed out the directions of the defendants regarding the plaintiff. She recovered, and after the interval of a year, brought an action against the two physicians, not for negligence or ignorance, or want of due care and skill in treatment, but for assaulting and ill-using her, and putting her under personal restraint. It was alleged that they were wrong-doers *ab initio*, and that there were no reasonable grounds to justify their proceedings. The trial ended in a verdict for the defendants.

There are three practical courses open to the practitioner, depending very largely on the financial position and other circumstances of the patient.

1. If the patient can afford adequate attendance in his own house, the physician should instruct the nurses in their duties, making sure that his instructions are understood, and he should retain charge until he is satisfied that *his personal supervision can be dispensed with*.

2. If the patient cannot afford the necessary nursing staff, the physician must explain to the relatives or friends the urgent necessity for temporary supervision, and arrange for them to order things on their own personal responsibility.

3. If neither of these courses is possible, the physician should report the case immediately to the duly authorised officer of the district, who must then act in his *official* capacity and take full responsibility for the case. The physician may or may not think it advisable to issue an urgency order under the Acts, but a general practitioner would be well advised not to do so on his own responsibility.

FEIGNED INSANITY

Insanity is occasionally feigned by persons accused of criminal offences in order to prevent a trial, to procure an acquittal, or to escape the consequences of the act. Insanity is very rarely, if ever, feigned until *after* the commission of the crime.

The following case of feigned insanity was the subject of a trial in London:—

A woman was charged with uttering a forged cheque: she had craftily procured the signature of a person under a false pretence, and then forged his name to the cheque. When required to plead she made no answer, and appeared unconscious of the question. She took up some flowers placed in the dock, and crumbled them in her fingers, which were in continual motion. She stared wildly at times, changing her position—turned her back on the court—muttered indistinct exclamations, and made a humming noise. She was placed under some restraint in order to prevent her from jumping out of the dock. Evidence was given that at previous periods of her life she had used incoherent language and was strange in her conduct. It was also shown that her mother, aunt, and sister had been insane. One medical witness thought that the prisoner was feigning, for she appeared to be fully aware of the importance of the plea of insanity; but when he heard that other members of the family had been insane, he thought that she was insane. Another medical witness, who had attended her family professionally, and had known the prisoner long, thought that she was not insane. Other witnesses said that they had never observed any acts of insanity about her. When arrested, she tried to escape and to conceal the money which she had procured by means of the forged cheque. The prison surgeon thought that she was feigning; he visited her daily, and he observed that her manner was changed as soon as she saw him. She put on a wild look when she knew that she was being observed, but when privately watched her behaviour was like that of a rational person; she generally slept soundly. The jury found that she was of sound mind; she was then called on to plead to the charge, but she refused. She was found guilty.

A judge has said: "It may be safely held that the person feigning insanity will rarely, if ever, try to prove himself to be sane; for he runs the great risk of satisfying others that he is sane, a conclusion which he obviously desires to avoid. But there is no better proof, in general, that the insanity (supposing other evidence of it to be strong), is real, than keen and eager attempts by the accused to prove that he is sane, and strong and indignant remonstrance against being held to be insane, although they would protect him against trial and punishment."

A trial took place at Chelmsford Assizes in which a clergyman was charged with making a violent and unprovoked assault on a policeman. When a suggestion was made that his conduct was that of an insane person, he protested strongly against the jury returning a verdict to that effect. He would not allow this defence to be set up for him. His conduct, however, in court, left no doubt that he was then of unsound mind as well as when he committed the assault, and the jury, in spite of his strong protestations, acquitted him on the ground of insanity.

It is certainly not profitable and may often be quite impractical to attempt to draw a hard and fast line between malingering, and hysterical pseudo-dementia or pseudo-psychosis (Ganser Syndrome)[1] when confronted with apparently simulated symptoms of bizarre behaviour in an accused person. The patient may claim loss of memory for large sections of past life, refuse to recognize relatives, and, for example, deny all knowledge of simple arithmetical methods. There may be acting out of behaviour considered typical of insanity by the patient, with alternating excitement and stupor, and suicidal gestures. Sometimes the patient may give a response which is directly and seemingly deliberately absurd in the context of the question: "How many legs has a cow?"—"Five"; or make no attempt, or a totally incorrect one, to

[1] Ganser: 1898. *Arch. Psychiat. Nervenkr.*, 30, 633.

repeat as few as three or four consecutive digits. Such complete abrogation of mental function is virtually never seen in dementia of organic origin.

Apart from a detailed history and a careful and preferably expert clinical examination, the opportunity of seeing any writing produced by the patient may sometimes be helpful. In the different forms of insanity the writing presents characters which cannot easily be mistaken. Writing being one of the evolutionary characters which have been acquired later, is one of the first to be affected in mental diseases, and therefore is a most useful index of deterioration. The patient may therefore be provided with writing materials, invited to use them, and left to himself.

This plan may succeed in revealing the existence of a latent delusion, when an examination would wholly fail, the patient would not be led to suspect that he was being subjected to an examination for a hostile purpose. He would not be influenced by the suspicion that the act of writing was to test the state of his mind; and as no man who does not think connectedly can write long in a connected manner, so we may expect to find ample evidence whether a delusion exists or not.

In idiocy there is no capacity for writing. In dementia, as memory is defective, it commonly happens that the same words or word are written over and over again. No person in a state of confirmed dementia can write a connected sentence, because before the last part of the sentence is completed the first is forgotten. In imbecility we may meet with every variety of mental defect, but the state of the mind is generally indicated by the expression of the thought in writing.

The method of writing is nearly the only plan which can be adopted when the person refuses to answer questions, and maintains a state of taciturnity for days and weeks. If furnished with writing materials, persons of unsound mind will often, in secret, voluntarily draw up petitions, addresses, or wills, which will reveal their real state of mind. For further details of this symptom the reader should consult a modern work on mental disease.[1]

Feigned Deaf-Mutism

For the same purpose of evading responsibility, persons may feign to be deaf and dumb. Such cases of malingering come much more frequently before the medical man in his primary capacity than when acting as a witness, but they may be noted here. Occasionally they occur in police-court cases where the minor offence, for example, of begging is in question, or obtaining charity by false pretences. It will be found that the alleged deafness and dumbness did not appear until a motive for feigning existed, and that there was no apparent cause except that of evading responsibility for an offence.

Sometimes the character of the offence is more serious.

In R. v. Yaquierdo, the prisoner, who was charged with murder, was found by the jury to be wilfully mute. The man refused to plead, although it was obvious that he was well aware of the nature of the proceedings. No counsel could be assigned to him, as this could not be done without the prisoner's consent. He was convicted.

It is sometimes suggested that persons suspected of malingering should be tricked into abandoning their pretence by counter measures involving deceit on the part of the doctor; for example by the announcement of an intention to perform some alarming operation on the patient, made in his hearing. This amounts to a threat and is both ethically wrong and legally

[1] *Clinical Psychiatry.* Mayer Gross, Slater, & Roth. Cassel, London, 1954.

indefensible. Moreover it must never be forgotten that no examination or investigation of any kind whatever may be attempted upon an accused person, awaiting trial or on remand, without his consent.

It should also be remembered that in states of possibly or apparently feigned insanity or dementia, considerable caution in diagnosis is wise. Many of these patients have been discovered subsequently to be epileptic, or suffering from unsuspected schizophrenia or organic brain disease. The beginning of the illness has been marked by the danger signal of hysteria, for which the environment, for example that of prison, has provided the final stimulus. A similar hysterical colouring of the earliest stages of progressive physical or mental illness, under the influence of emotional stress, is becoming increasingly recognized in clinical medicine.

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